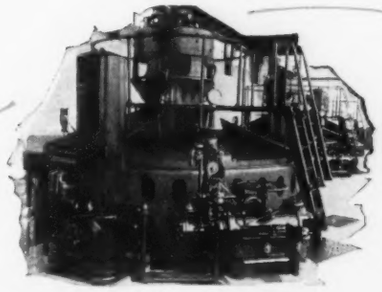
JUL 14 1924

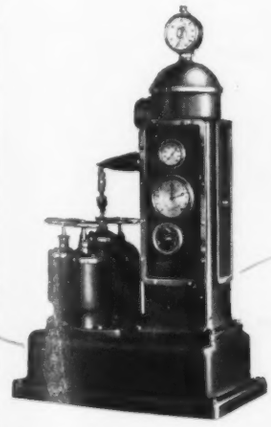
Founded March 1, 1874—Fifty Years of Service

Electrical World

McGraw-Hill Company, Inc. *July 12, 1924* Twenty-five Cents per Copy



Woodward Governors have been installed by leading engineers in many countries—are used with finest turbines and govern water wheels of all types—Woodward Governors are designed to provide for every hydro-electric power plant requirement—They have aided materially in the development of water power.



WOODWARD GOVERNOR COMPANY, *Rockford, Illinois, U.S.A.*

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Does this city differ from yours?

Metropolitan Rotary

Open Position

Here a fuse renewal costs from 60 cents to $1.00. Yet conditions are favorable to low servicing charges. Where customers are in the suburbs, costs are higher. And on rural lines, the cost of servicing a single fuse renewal may exceed the cost of the meter switch itself.

This Metropolitan AA Rotary Meter Switch is offered as the real solution in reducing service costs. The customer renews the fuse.

With the Metropolitan AA Rotary there is no reason for breaking seal to replace fuses. One operation, moving handle to "off" position, brings fuses to view and disconnects all sources of current. A complete statement of all the facts will interest you. And we have data, too, of considerable value to you. For your convenience, use the coupon.

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

Gentlemen: Please send full information on the Metropolitan AA Rotary Meter Switch.

Name ..... Company .....

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Canada Leads in 1923 Electrical Exports from United States

Electrical Exports Increasing

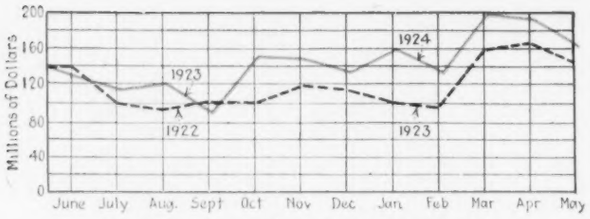
THE year 1923 witnessed business conditions throughout the world, with the exception of certain parts of Europe, more satisfactory from the viewpoint of electrical manufacturers than at any time since the war. To some extent this was the result of improved economic conditions, but, taking the world as a whole and speaking generally, a rising standard of living must also be credited with increasing the demand abroad for all classes of electrical goods. The total value of all electrical exports during 1923 was $72,158,241, a gain of 14.4 per cent—a large gain, considering the increasing foreign competition.

The greatest volume of electrical exports went to North American territory, with Canada continuing as the largest customer in these nearby fields, though there was good improvement in both Cuba and Mexico. To Japan, however, in the form of transformers, went the largest exports as far as value was concerned. The volume of exports to Japan during 1923 of large generators, transformers, switchboard equipment, switching gear and the like was to be expected in view of the activity shown by Japanese interests in continuing the development of the water-power resources of the country. The heavy importation of motors and of insulated wire and cables is interesting as indicating that business can be done in these lines in Japan in spite of the large local production of such apparatus and materials.

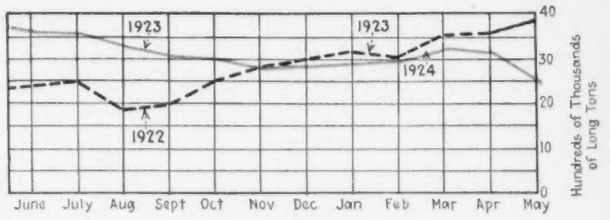
The first quarter of 1924, with a gain of more than 28 per cent over the same period of last year, seems to point to even greater gains in annual electrical exports. Foreign manufacture and low labor costs do, of course, hold down the foreign sales of American-made goods, but superior quality and sales methods appear to uphold American supremacy.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

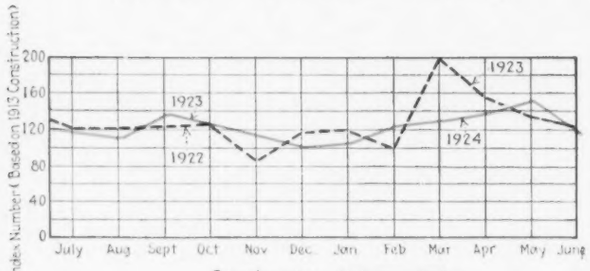
How the Primary Industries Are Trending



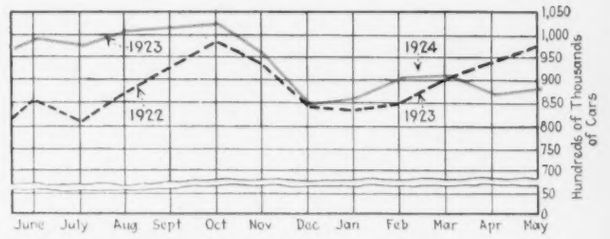
Contracts Awarded for Residential Buildings



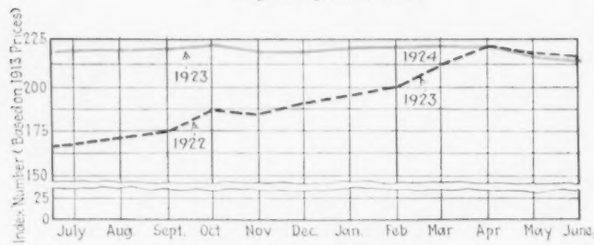
Pig-Iron Production



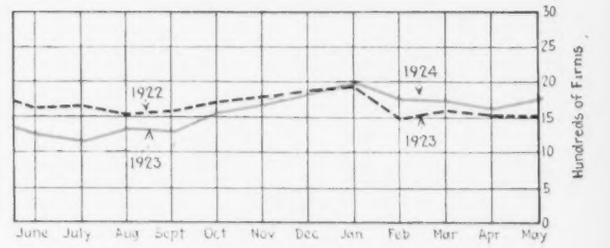
Construction Volumne Index
(Engineering-News Record)



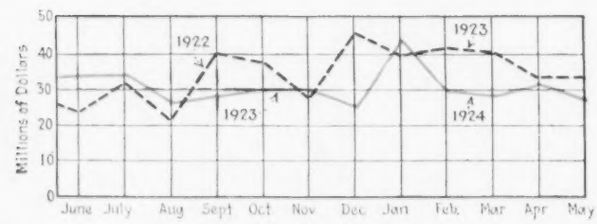
Total Average Weekly Freight-Car Loadings



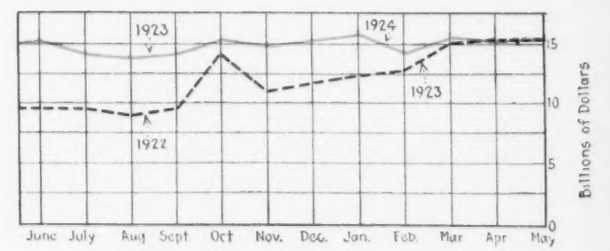
Construction Cost Index
(Engineering-News Record)



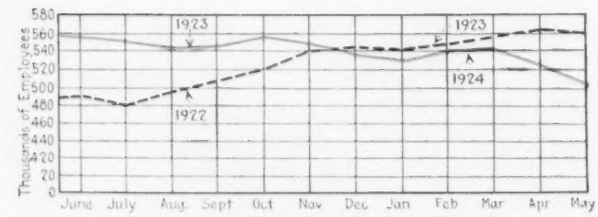
Business Failures



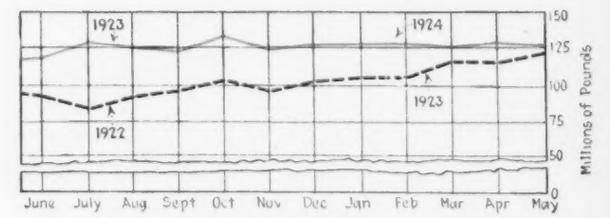
Fire Losses



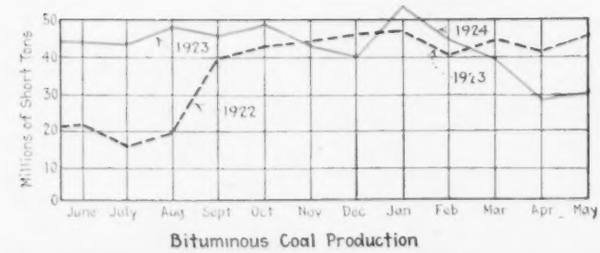
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Production Decreases During May

THE production of basic commodities and factory employment showed unusually large declines in May, and both were considerably below the level of a year ago. Operations in the electrical industry as a whole, while following this general trend, were more active and were by no means below those of last year.

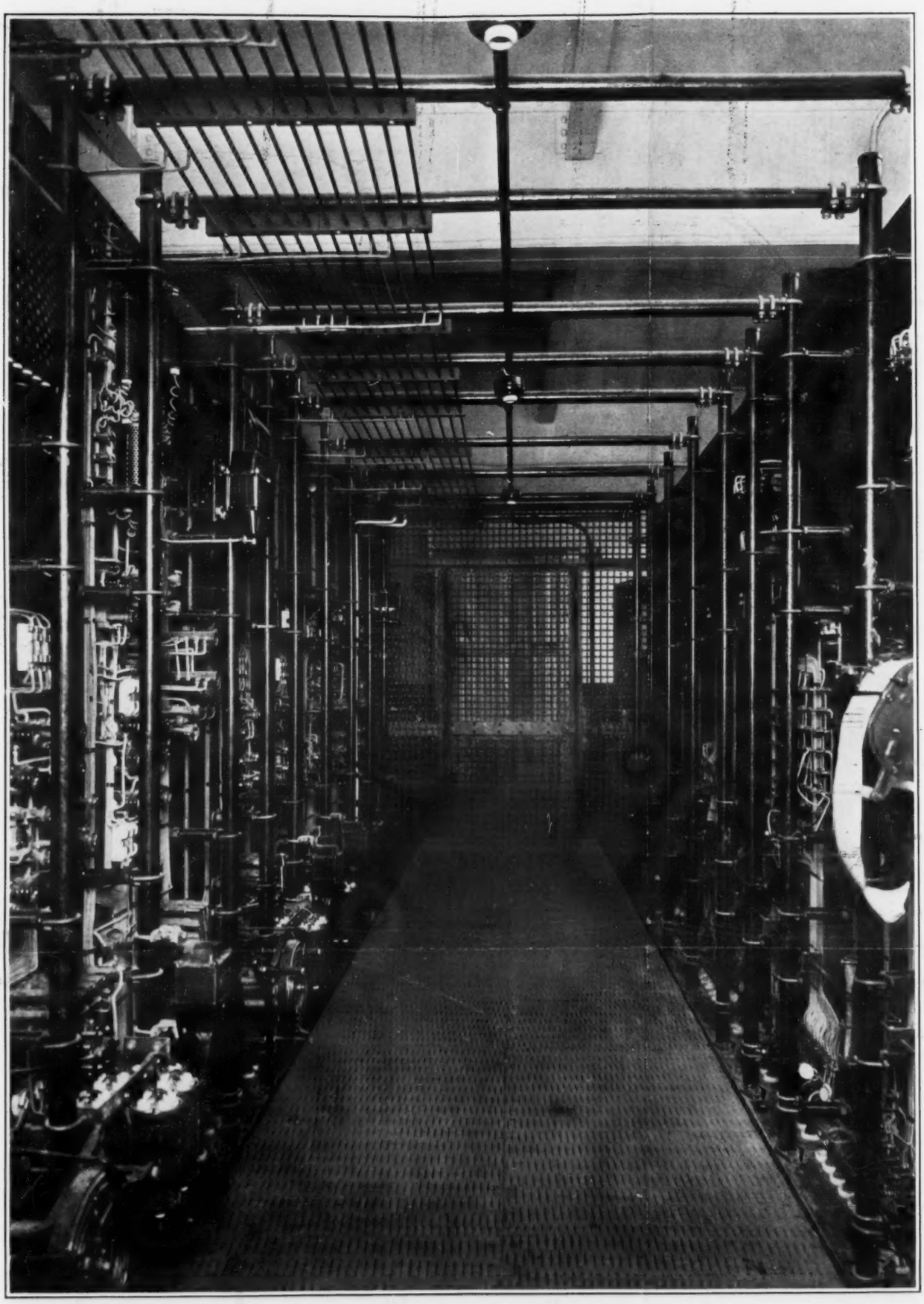
Features of Pine Grove Station

A Mouth-of-Mine Steam Plant

THE design of a mouth-of-mine steam plant under conditions in which energy is delivered to high-tension lines and in which the ultimate rating is difficult to predict requires departures in past practices and presents unusual opportunities for securing simplicity and economy without sacrificing reliability. In the Pine Grove Station of the East Penn Electric Company some unusual design features have been incorporated. Each generator, transformer and exciter is considered as a unit and all main switching is done at high tension. The lighting layout, the control applications and the switchboard wiring are examples of design thinking applied to this type of station. The initial installation is 25,000 kw. and the ultimate rating of the plant is expected to be about 200,000 kw.

A Compact Switchboard Room

The operating aisle in the switchboard room, showing house service control board on the left, the main control and battery board to the right and the Frink diffusers at the ceiling



Neat wiring improves the appearance of the aisle between the control board and the relay board

RELAY BOARD

PANEL #109 - TRANSFORMER #1 | PANEL #110 - TOTALIZING WM. | PANEL #111 - GENERATOR #1

CONTROL BOARD

PANEL #11 - GENERATOR #1

Differential Auto-Transformers

Curve Dr. Totalizing Wattmeter.

Relay (PQ-6 Y2)

RL.1.

Differentially Conn. Relays (PQ 6) (Hand Reset)

Bell Al Bus

Auxiliary Relays

RES

T.D.

Gr Bus

W.H.M.

W.M.

V.M.

A.M.

T.I.

R.V.A.

D.C. Voltmeter Buses

Frequency Ind. Buses

F. L.

Auto Transformers

C.S. Gen. Fld.

F. (51) C.Sw. Exc. Fld.

L.R.

L.G.

R.E.

R.E. Bayonet Type

Governor C.Sw.

Synchronizing Buses

Locking Buses

Contact next to Panel

Contact away from panel.

Test Sw

To Signal Switches Panel #12

To Voltage Adjusting Switch

C-Plug breaks contact first

Supply Switch

LOAD INDICATOR ENGINEERS OFFICE

LOAD INDICATOR BOILER HOUSE

On Air Washer Thermometer

Synchronizing Plug Starting

Synchronizing Plug. Running.

Potential Plug (A.C. For V.M.)

Potential Plug (D.C.)

Upper 66000 Volt Bus

Lower 66000 Volt Bus

5-3AC

Disconnecting Push Button Sw.

5-3A

DISC. SWITCH NO. 2

5-3AB

1 H.P. Motor for Oper. Disc. Switch.

5-3BD

5-3B

DISC. SWITCH NO. 1

5-3BA

TERMINAL BOX No. 3 (Sub-Station)

5-3F

5-3G

5-3H

C.C.

C.R.

T.C.

Insulating Transformer

Temp. Coil

Oil Circ. Bkr.

C.T.

Transformer No. 1. 6000 K.V.A. 3 Phase, 60 Cycle

On Thermometer

5-3C

TERMINAL BOX No. 13

5-3D

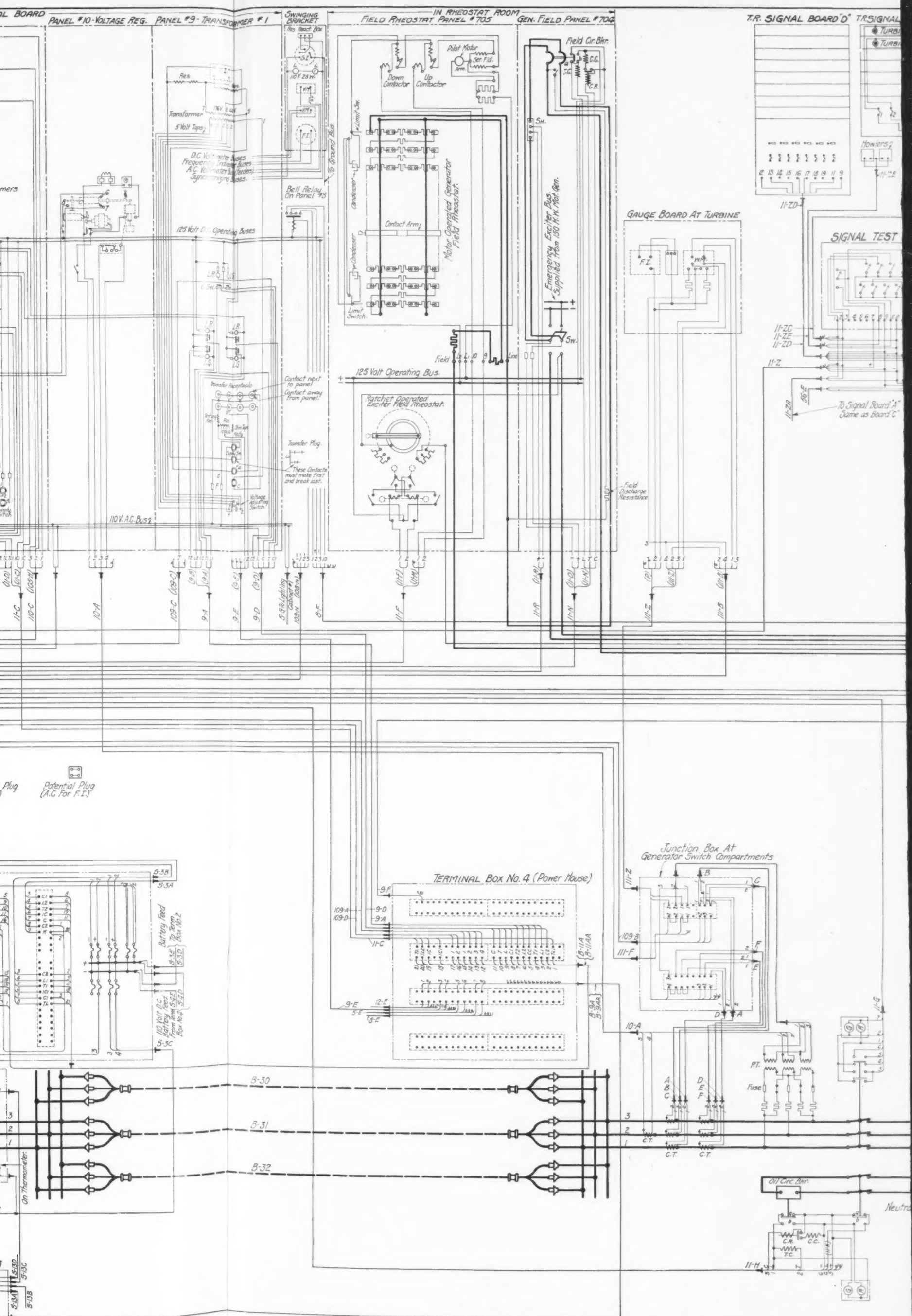
5-3E

5-3J

5-3K

B-9AA

17 Spares



~: SYMBOLS :~

AM - Ammeter.
a - Auxiliary Switch Open when main switch is open.
b - " " " " " closed
C.C. - Closing Coil.
C.R. - Closing Relay.
C.Sw. - Control Switch.
C.T. - Current Transformers.
F - Fuse.
F.I. - Frequency Indicator.
L. - Lamp.
L.G. - Lamp, Green.
L.R. - Lamp, Red.
P.T. - Potential Transformer.
RE - Receptacle.
RES. - Resistor.
R.I.1. - Relay, Instantaneous.
R.I.2. - Relay, Inverse Time Limit.
R.V.A. - Reactive Volt Ampere Indicator
SH. - Shunt.
Sw. - Switch.
T.C. - Trip Coil
T.D. - Testing Device.
T.I. - Temperature Indicator
V.M. - Voltmeter.
W.M. - Wattmeter.
W.H.M. - Watthour Meter.

Complete Statio

The switchboard, con
designed to give adeq
reliable control and

CONTROL BOARD

PANEL #111 - GENERATOR #1 | PANEL #11 - GENERATOR #1 | PANEL #10 - VOLTAGE REG. | PANEL #9 - TRANSFORMER #1 | SWINGING BRACKET | IN F... | FIELD RHEOSTAT PA...

W.H.M. | V.M. | A.M. | A.M. | A.M. | A.M. | T.I. | R.V.A.

D.C. Voltmeter Buses | Frequency Ind. Buses | P.T. | Auto Transformers

C.S. Gen. Fld. | C.Sw. Exc. Fld. | 65A | L.R. | L.G. | R.E.

R.E. Bayonet Type | Governor C.Sw. | Synchronizing Buses | Locking Buses

Contact next to Panel | Contact away from panel.

Test Sw. | To Signal Switches Panel #14 | To Voltage Adjusting Switch | Supply Switch | Res.

A=C, B=C. C Plug breaks contact first

Res. | Transformer | 5 Volt Taps | 115 V. | 18 V. 25 W. | W.M. | F.I.

To Ground Bus | D.C. Voltmeter Buses | Frequency Indicator Buses | A.C. Voltmeter Buses | Synchronizing Buses

Bell Relay On Panel #13

125 Volt D.C. Operating Buses | L.R. | C.Sw. Cl. | L.G.

Transfer Receptacle | Contact next to panel | Contact away from panel.

Transfer Plug. | These Contacts must make first and break last.

Voltage Adjusting Switch

110 V. A.C. Buss

Down Contactor | Up Contactor | Limit Sw. | Condenser | Condenser | Contact Arm | Limit Switch | Motor Operated Generator Field

125 Volt Operating Bus.

Ratchet Operated Exciter Field Rheostat.

W.H.M. | T.D. | T.D. | P.T.

R.L.1. | Differentially Conn. Relays (Pg 6) (Hand Reset)

On Air Washer Thermometer

Synchronizing Plug Starting | Synchronizing Plug Running | Potential Plug (A.C. For V.M.) | Potential Plug (D.C.) | Potential Plug (A.C. For F.I.)

Disconnecting Push Button Sw. | Disc. Switch No. 2 | 5-3A | 5-3AB | 1 H.P. Motor for Oper. Disc. Switch

TERMINAL BOX No. 3 (Sub-Station) | 5-3B | 5-3A | 5-3F | 5-3G | 5-3H | 5-3C | Battery Feed To Term. Box No. 2 | 110 Volt D.C. Battery Feed From Term. Box No. 1

Insulating Transformer | Temp. Coil | C.C. | C.R. | T.C. | C.T. | Oil Circ. Brr. | Transformer No. 1. 16000 K.V.A. 3 Phase, 60 Cycle | On Thermometer.

B-30 | B-31 | B-32

Disc. Switch No. 1 | 5-3BA | 5-3B

TERMINAL BOX No. 13 | 5-13D | 5-13C | 5-13A | 5-13B | 17 Spares | B-9AA

~: SYMBOLS :~

AM - Ammeter.
a - Auxiliary Switch Open when main switch is open.
b - " " " " " closed
C.C. - Closing Coil.
C.R. - Closing Relay.
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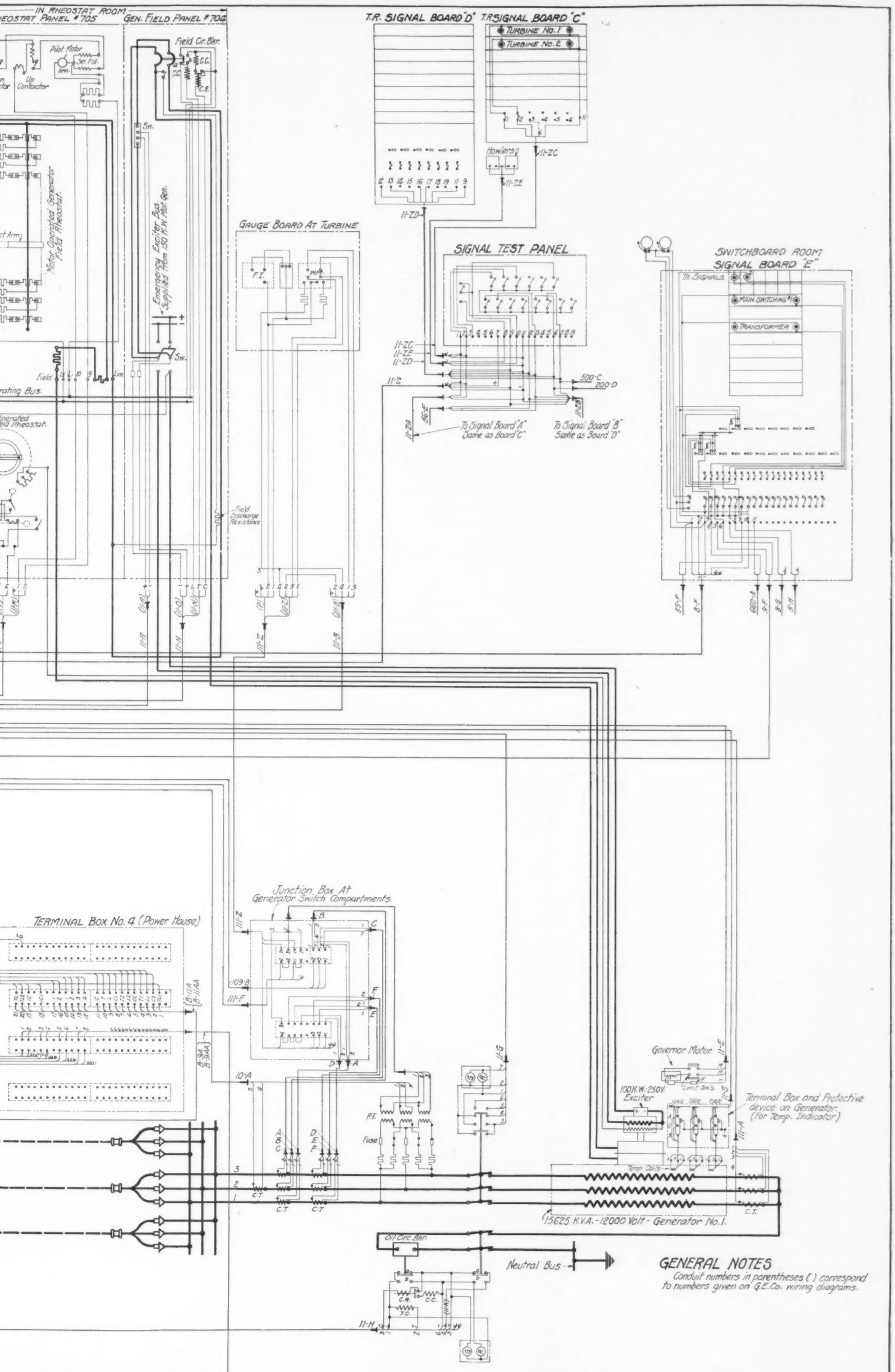


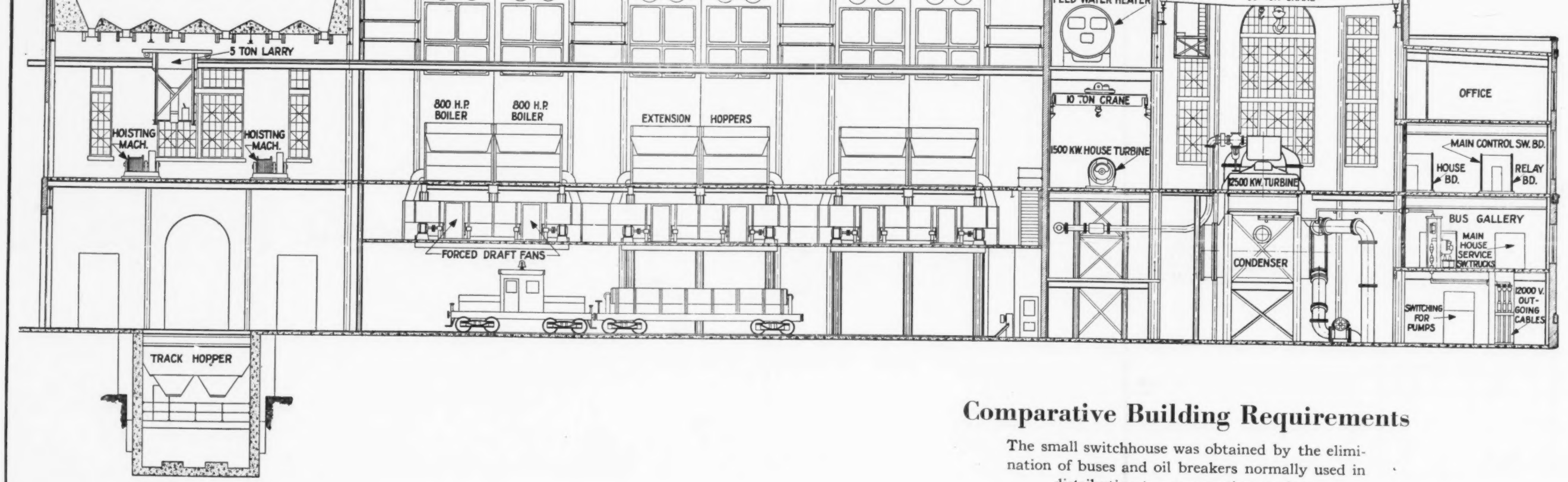
SH. - Shunt.
Sw. - Switch.
T.C. - Trip Coil
T.D. - Testing Device.
T.I. - Temperature Indicator
V.M. - Voltmeter.
W.M. - Wattmeter.
W.H.M. - Watthour Meter.

GENERAL NOTES

Conduit numbers in parentheses ( ) correspond to numbers given on G.E.Co. wiring diagrams.

Complete Station Wiring Diagram

The switchboard, control and auxiliary wiring is designed to give adequate records, accurate and reliable control and maximum ease in operation



Comparative Building Requirements

The small switchhouse was obtained by the elimination of buses and oil breakers normally used in distribution type generating stations

1000 TON BUNKER
SKIP HOIST
50000 GAL. TANK
FEED WATER HEATER
60 TON CRANE

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

Volume 84 New York, July 12, 1924 *Number* 2

Another Great Loss to Electrical Engineering

ONCE more the electrical industry has to mourn the loss of a great engineer whose name is written large across the record of unbroken progress which is its history. Benjamin G. Lamme's death at sixty is a calamity. In the field of design he stood conspicuous as a leader in fields that embraced railway apparatus, industrial motors, rotary converters and waterwheel generators. Less well known to the general public than Charles P. Steinmetz, his junior by one year, whose death is not yet nine months in the past, Lamme was to the Westinghouse company what Steinmetz was to the General Electric—the man whose name came first to the mind of the electrical fraternity when the personnel of the great manufacturing company with which he was identified was in review. As a technical writer he was pre-eminent for the clearness of his thought and of its presentation and for his ability to work out his conclusions with minimum resort to mathematics. With no taste for self-advertisement, Mr. Lamme found delight in discovering talent in others and in training young men to serve his beloved industry faithfully and well. His premature removal leaves another gap in the ranks of the veterans—few of whom are really old.

Water-Power Laws Needed in Many States

WHATEVER may be the ultimate outcome of the contest between the states and the national government over the ownership of the water powers, the situation at present leads to bitterness and reflects unjustly on the good faith of the power companies. The contention is that the states own the water powers even when they are situated on the public domain and that the national government merely owns the land. At any rate two permits are necessary, one from the state and the other from the Federal Power Commission. Where the states have no settled water-power policy, the grant is usually made in perpetuity even though a federal license is limited to fifty years. Hence the popular notion that the people are being placed at the mercy of the power companies and robbed of their birthright. Little faith apparently is placed in the public service commissions, which are looked upon as tools in the hands of vested interests.

Undoubtedly this feeling has had much to do with the spread of municipal ownership on the Pacific Coast. Under the mistaken belief that once they parted with their water powers they were without redress, communities there seem inclined to turn for succor to the local governments rather than to private corporations, even though regulated. How much better it would be for the communities and for the power companies also if each state would determine upon a water-power policy and enact legislation providing for a definite period of lease and for recapture at the end of that time on payment of just compensation. People then would know that they were not parting with their natural resources forever and that the state was receiving a fee for the use of the water. Such laws would relieve the power companies of embarrassment and unjust criticism, while at the same time guarding every interest of the state and of the taxpayer. It is presumed, of course, that reason and not prejudice would prevail in the enactment of such legislation, and the ELECTRICAL WORLD knows of no better pattern than the federal water-power act itself, modified to suit conditions.

Hands Across the Sea

MUCH good should result from the unusually large migration of American engineers to Europe this summer. The drawing power of the World Power Conference, the Wembley Exposition and the many scientific gatherings has been the direct incentive to many American engineers, but back of this lies their recognition of the need existing in Europe for engineering applications on a scale closely approximating that already achieved in this country. Unselfishly and eagerly they have gone abroad to give their knowledge and talents to the older civilizations.

It is significant of the status of engineering in the modern world to find international wellbeing based in great degree on engineering. The economic experts say engineering remedies are required for the ills of civilization, and statesmen in all countries call in the engineers as accredited and competent consultants. Beyond the mere material and practical benefits rendered by engineering works lies a realm of social understanding which has a potent influence on international political relations. For example, the engineer has been a large factor in rendering impossible a recurrence of the international ill feeling that was stirred up in former generations by the comments of British writers and travelers on America and Americans and which became especially acute after the first American trip of Charles Dickens. Now the human family in all parts of the world has become so well acquainted that understanding and sympathy have a real chance to replace ignorance and prejudice as a basis for judgment upon other lands and peoples.

It is very encouraging to find such a mingling of international engineers on a plane of good fellowship, for although American engineers can probably give many ideas and facts to their friends across the sea, they also can receive much from the European engineers who have lived in an environment where artistry, permanence, economy, conservatism and thoroughness have guided developments. In every way international visits of engineers should be fostered, and it is hoped that another summer will see a wave of European engineers approaching our shores to cement further international engineering comity.

Western Municipalities Determined to Go Into Electric Business

IT IS apparent from the number of petitions filed at Olympia last week that two of the municipalities of the State of Washington are determined to go into the business of generating and selling electricity outside of their corporate limits. Seattle has been engaged in this line of work to a limited extent for some time without legal right, and if the Bone bill is passed next November can be counted on to compete with the power companies in the Puget Sound district quite extensively. The same is true of the city of Tacoma. Being relieved of the burdens of taxation, both municipalities might undersell the local power companies with telling effect. However, if the people of Seattle have profited at all from their experience with the municipally owned street-railway system and its increased fares, and if this lesson be not lost on the rest of the inhabitants of the state, it is unlikely that other cities will embark on a losing venture.

Some one must pay for government and governmental functions. The power companies at present are the heaviest taxpayers in the community, and unless the city is to shirk its civic duties, the funds, if the power companies are bought up or driven out of business, must be paid by the taxpayers, however indirect the tax may be. Moreover, it is doubtful if the rest of the state would be content to turn over the power business to Seattle and Tacoma. Not all of the cities have an itching palm, and most of them seem to be content with the service they receive and with the utility companies rendering that service. Besides, in Spokane, for example, the average rate for electricity is lower than the rates obtaining in Seattle and Tacoma at present under municipal ownership. If the number of petitions received in Spokane be any index of popular feeling toward the Washington Water Power Company, it is evident that the Inland Empire has no stomach for the socialization of the electric light and power industry in Washington, nor have many of the other cities. Thus the situation resolves itself into a case of Seattle and Tacoma against the rest of the state, with the chances that the votes of the rest of Washington will prevail.

Is Alternating-Current Transformation Employed Too Freely?

THE ease with which alternating current can be transformed leads in many cases to too free a use of transformer equipment and consequent losses in energy and lowering of service standards. It is all too common an experience to find banks of substation transformers through which the voltage is stepped down to a low value and then up again to serve a group of customers at such a distance that the lower voltage cannot be used. The result is a constant loss in energy that mounts into a startling number of kilowatt-hours annually. Regulation and service are not improved by such an arrangement, and extra hazards are produced from multiplying the apparatus.

Generally the reason for the multiplicity of transformations is an emergency call for service coupled with carelessness in following up the temporary measures with permanent arrangements, or else some one has figured that the original cost of the installation is lower than would be the case if the proper measures had been adopted. In either case the arrangement marks the beginning of a hodgepodge system that is a source of constant embarrassment and, what is far worse, an expense that is none the less real because it does not stand out on the monthly balance sheet. The unfortunate part of the situation is that the losses are small at first and because of their nature are difficult to see. They keep on growing under the incessant call for service until they result in service embarrassments that are serious. By this time they have grown from a condition with a relatively simple remedy to one that requires heavy expenditures involving a difficult problem in themselves. The fact that it is easy and convenient to use transformer banks is one powerful reason why their use should be guarded to see that the object for which they are employed is not defeated by using them so freely that the system efficiency is lowered and service suffers.

Public Relations in a Club Car

PUBLIC relations are talked about at length and frequently along very general lines, yet a pleasant reaction ensues when generalities are replaced by specific incidents. Recently a conversation occurred on a club car which carried to the eavesdropper a complete conception of good public relations. The group of men in the club car were talking of business conditions and the general trend of radicalism. At length one of the group said:

"I believe half the troubles of business firms and utility companies would be removed if executives followed the policies developed in the city of X by the light and power company. It is a pleasure to write out a check for the monthly power bill. This company gives courteous service under all conditions and does it on a personal basis that warms the heart. I happen to be the factory manager of a firm that has factories in many cities in the United States and Canada, and my experience with other utilities leads me to say that the company in X is far in the lead in developing good customer relationships. As a result I have placed complete confidence in the company representatives and followed their advice, and I have never heard anything but good words for the company in all my visits to X. Every one is treated fairly, and even the wives of our employees boast about the good service given by the light and power company."

This incident merely points the moral that good public relations are obtained by action only and that the "how" as well as the "why" of the subject should be considered. For even though good public relations are mostly matters of the heart, the heart must beat and send the warm life blood coursing throughout the corporate body to energize it and keep it at all its tasks unceasingly.

Centralized Sales Effort for Small-Town Departments

THE proximity of several small-town lighting departments to a larger central-station center which may be supplying energy to these departments at a wholesale rate suggests the desirability of an arrangement under which the residents of these communities can obtain the benefits of the operating company's progressive commercial policies. There is no doubt that the inhabitants of many such small towns suffer materially from the inability of a town department of very limited resources to carry on any comprehensive commercial development. These people get the benefits of centralized energy supply and may or may not enjoy

satisfactory retail service rates. Be that as it may, central stations are disposed to co-operate in making their own stores and offices centers of electrical convenience and development; but too often the cultivation of the outer local districts not formally within franchise limits lacks the benefits of a unified and intelligent commercial policy. The best solution, where economic conditions warrant it, would seem to be the abandonment by the town of municipal electric service; but in the absence of this it would appear well worth while to look into the possibilities of a mutual agreement under which the central-station sales organization's resources may be applied to the development of business in the local territories already dependent upon it for energy.

A Propitious Time for Selling Street Lighting

STREETS built for the slow vehicles of bygone years were not particularly dangerous from the viewpoint of traffic. They were lighted chiefly as a protection against crime and as an aid to police patrol. With fast-moving traffic matters are now different. Even in the daytime accidents are numerous, but with inadequate lighting they are greatly increased. It has been estimated that traffic accidents in this country cost more than a billion dollars per year and that about 25 per cent of these are due to inadequate lighting. In other words, besides the various other benefits of good street lighting this country would save several hundred million dollars a year if its streets were properly illuminated. Since 1919 the number of automobiles has doubled, and there is no reason to believe that traffic conditions will not get worse. Street-lighting improvements and extensions have always been needed, and this need is rapidly growing more urgent. No one who has driven or dodged automobiles will fail to recognize the greater safety of adequately illuminated streets. Even the problem of glare from automobile headlights is pretty well solved where streets are well lighted.

Why is not the present time propitious for street-lighting improvements? Money is cheap and plentiful. Gold is piling up on every hand. It wants work to do. Bond issues can be advantageously floated under conditions which are seldom more attractive than at present. More and better street lighting is badly needed in many places. That it must be provided eventually is inevitable. Why not grasp the opportunity afforded by the present need and by the funds available? Improvement and extension of street lighting may be achieved now with less effort than when money is tight.

The New Range Manual and the Need for Facts

THE electric cooking and heating committee of the N. E. L. A. Commercial Section, through the Society for Electrical Development, has just published in four volumes an electric range manual which is probably the most useful production on the subject of selling and servicing the electric range that has ever been published. It is comprehensive, interesting and filled with practical guidance for the utility that has embarked upon the development of range load or decided to do so. But it does not present any evidence as to the value of range business or the experience of central-station companies that have been pioneering in this field.

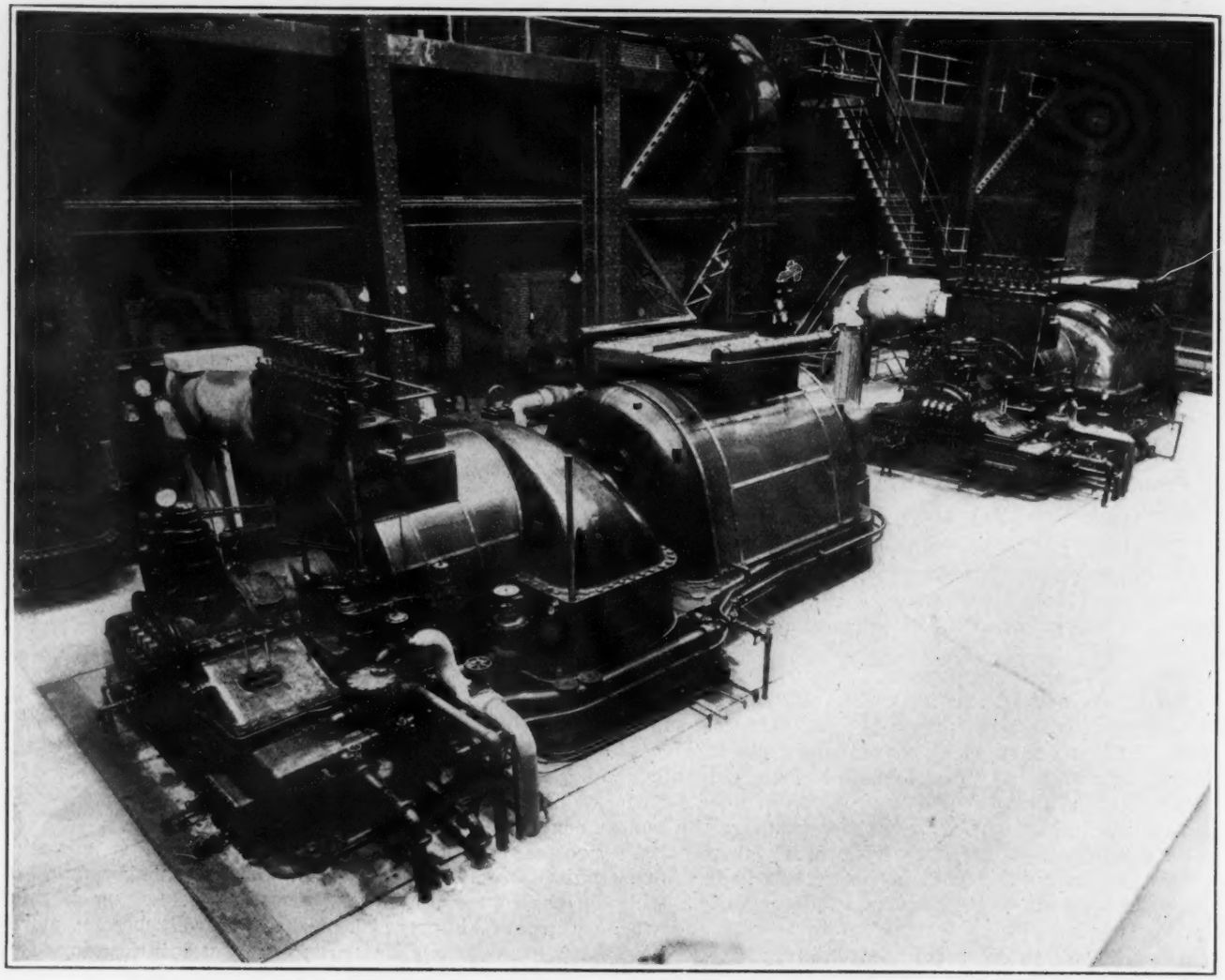
This statement is not made in criticism of the men of the society who published the book or of the N. E. L. A. committee who collaborated in its preparation. They all will admit and assert that this element is entirely wanting in this as in practically all other range literature. No comprehensive data were available of which to complie a fifth volume on range performance and experience, and so this, the most vital part of such a work, was left to wait the completion of the range committee survey now in process in the Northwest.

The point is that a study of this new range manual bears in again upon the reader the absolute necessity for the development of conclusive facts on the value of range load—its influence upon the customer and its effect upon the system. The Spokane survey will be a fine beginning, but the real need is for intensive studies by individual companies which will produce dependable data on their own load and adequate analysis of their own experience in selling, connecting and servicing the ranges on the lines. The value of the information that will come out of such a combined attack upon this problem will more than pay each company for its share of the work. Such a study should be started in support of the electric range and also of refrigeration.

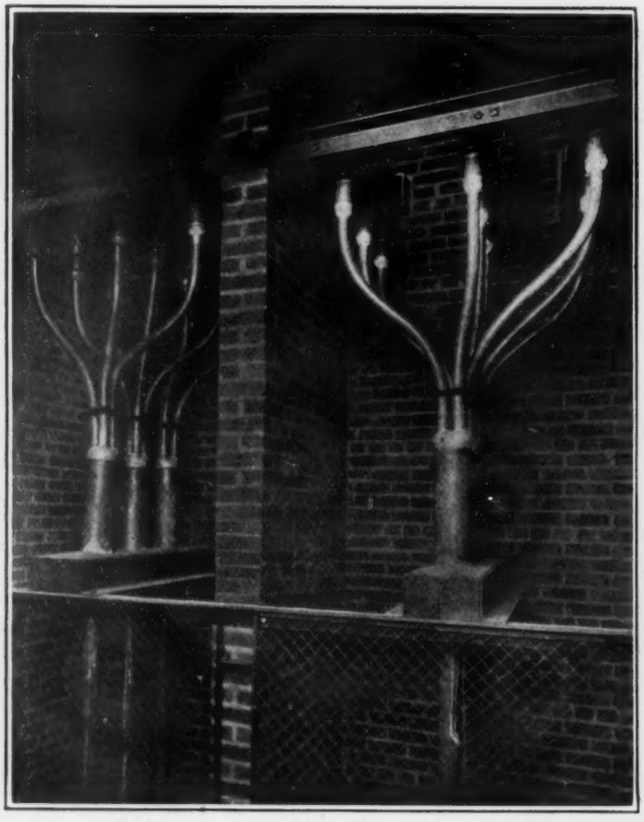
Are Electrical Men "Welding-Minded"?

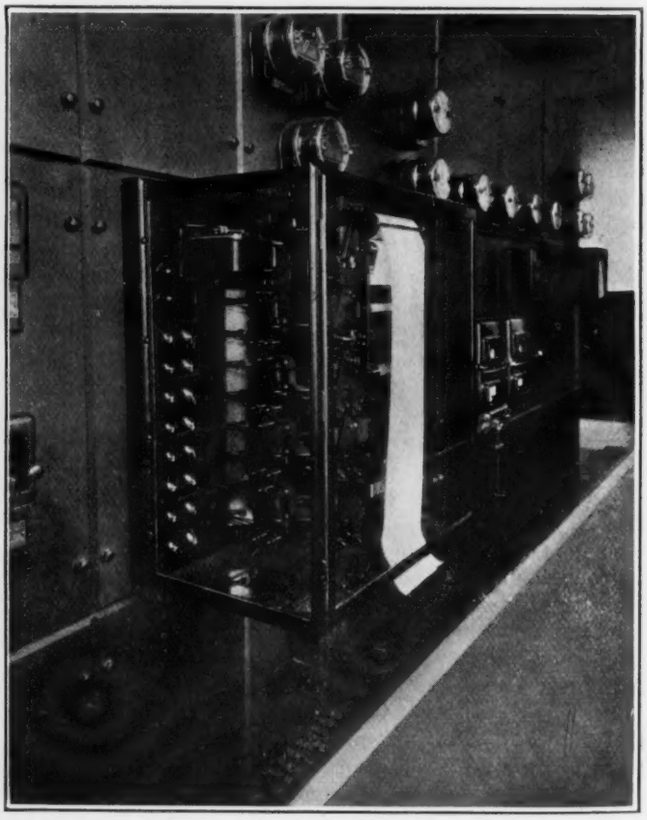
A CERTAIN manufacturer of electrical apparatus has made an extensive development of electric welding equipment. Starting with an enthusiastic confidence in the value of electric welding as a factory process, he has produced a successful welding unit and built himself a strong place in the growing market. In the course of the designing and perfecting of this equipment his organization has naturally become more and more keenly interested in possibilities for the application of welding in the construction and assembling of its own machinery, and has discovered and devised a surprising variety of ingenious uses for welded steel parts where bolted castings had been formerly employed. There has been great saving in weight of metal, labor and resultant costs. Resort to welding in its factory has steadily increased. In fact, the works manager frankly states that, were either necessary, he could more easily dispense with electric power than with electric welding.

The extent to which the use of welding has progressed and expanded in this factory—and in many others—clearly indicates how great a success it has become and the tremendous future promised for this great industrial utilization of electrical energy. The reason why this interested manufacturer of welding equipment has been able to develop the use of welding so far is that he himself is "welding-minded." He is "sold" on the possibilities of this process. He is approaching problems with the hope that here may be another place where welding will help him simplify and save, and so he finds new opportunities to weld. The trouble is that the average manufacturer is naturally prejudiced in favor of his established method and against an innovation. But the central-station power salesman can and should be "welding-minded" and, recognizing the importance of such a service to the manufacturer, set himself to find out how he can profitably serve the load. It is important that the entire electrical industry should be "welding-minded." For electric welding will revolutionize the methods of many factories when electrical men begin enthusiastically to search for and devise new ways to use this very effective industrial application of central station power.



NIGHT VIEW OF MAIN FLOOR OF PINE GROVE MOUTH-OF-MINE STATION





AT LEFT—CABLES CONNECT GENERATOR BARS TO OUTDOOR TRANSFORMERS. AT RIGHT—RELAY BOARD WITH TOTALIZING GRAPHIC WATTMETER

Electrical Features of Pine Grove Station

In Steam Plants of This Kind Remote from Their Load Centers the Requirements for Generation and Transmission Are Very Different from Those of a Station from Which a Distribution System Spreads Directly

By C. D. GRAY and M. M. SAMUELS
The J. G. White Engineering Corporation

THE electrical features of a large steam plant built at the mouth of the mine, remote from the load center, differ from those of the large city plant in many respects. The most important of these is the fact that whereas in the city plant the energy is sent out from the power house at generator voltage over a large number of circuits, in the mouth-of-mine plant it is stepped up to much higher voltages and transmitted over a few circuits.

The mouth-of-mine plant, electrically, resembles a hydro-electric plant. But here, too, there are two principal differences: The first is that, whereas in the steam plant the treatment of auxiliaries offers a very important problem, there is practically no such problem in a hydro plant. The second is that whereas in a hydro plant it is not always possible, particularly when the units are comparatively small, to make the transformer units of the same capacity as the generator units, it is practically always possible to do so in a large mouth-of-mine steam plant. Hydro plants that for economic reasons have more generator units than transformer units must have a low-tension bus at generator voltage and the respective low-tension switching. This is a problem which is not very difficult to solve for the reason that the ultimate capacity of a hydro-electric plant is generally known when it is designed and the short-circuit current can be easily estimated, and for the further reason that the short-circuit current of a hydro plant is not very great because of the considerable reactance of waterwheel generators. In the case of a mouth-of-mine steam plant, however, it is almost impossible to estimate the ultimate capacity to which the plant might grow in the future. It is therefore difficult to estimate the type of circuit breaker to provide on the low-tension switching to take care of the ultimate short-circuit current, which will be found to assume enormous proportions requiring very large circuit breakers and corresponding bus work, with the resultant requirements in building space which would make the cost of switching almost prohibitive. It may therefore be taken as a fortunate coincidence that in large mouth-of-mine plants it is possible to eliminate the problem of low-tension switching and bus work altogether.

This is done by making the transformer of the same capacity as the generator and connecting it to the generator as a continuation without any switching between the two, all the switching being done on the high-tension side. In some power houses of this type a transfer bus is provided, which can be connected to any one generator but to one only and used as a main station auxiliary bus. However, in the majority of cases it will be found advantageous to step down from the high-tension bus through a transformer for auxiliary purposes and to eliminate even the generator transfer bus. The latter would require a rather elaborate switching structure containing oil switches, disconnecting switches and bus work, the first cost and maintenance cost of which would be considerably higher in most cases than that of providing a high-tension auxiliary transformer.

All of the above simplifications and many other new features were employed in the design of the Pine Grove power house of the East Penn Electric Company, which may be properly used in a general discussion of the mouth-of-mine steam plant to illustrate the various electrical features involved. This power house, which is on the Swatara Creek at Pine Grove, Pa., has a present installed capacity of two 12,500-kw. units and an ultimate capacity of 200,000 kw. The auxiliaries and the signal system of this plant have already been described in detail. (See ELECTRICAL WORLD, July 7, 1923, pages 6-8, and August 4, 1923, pages 225-228.)

NO LOW TENSION BREAKERS

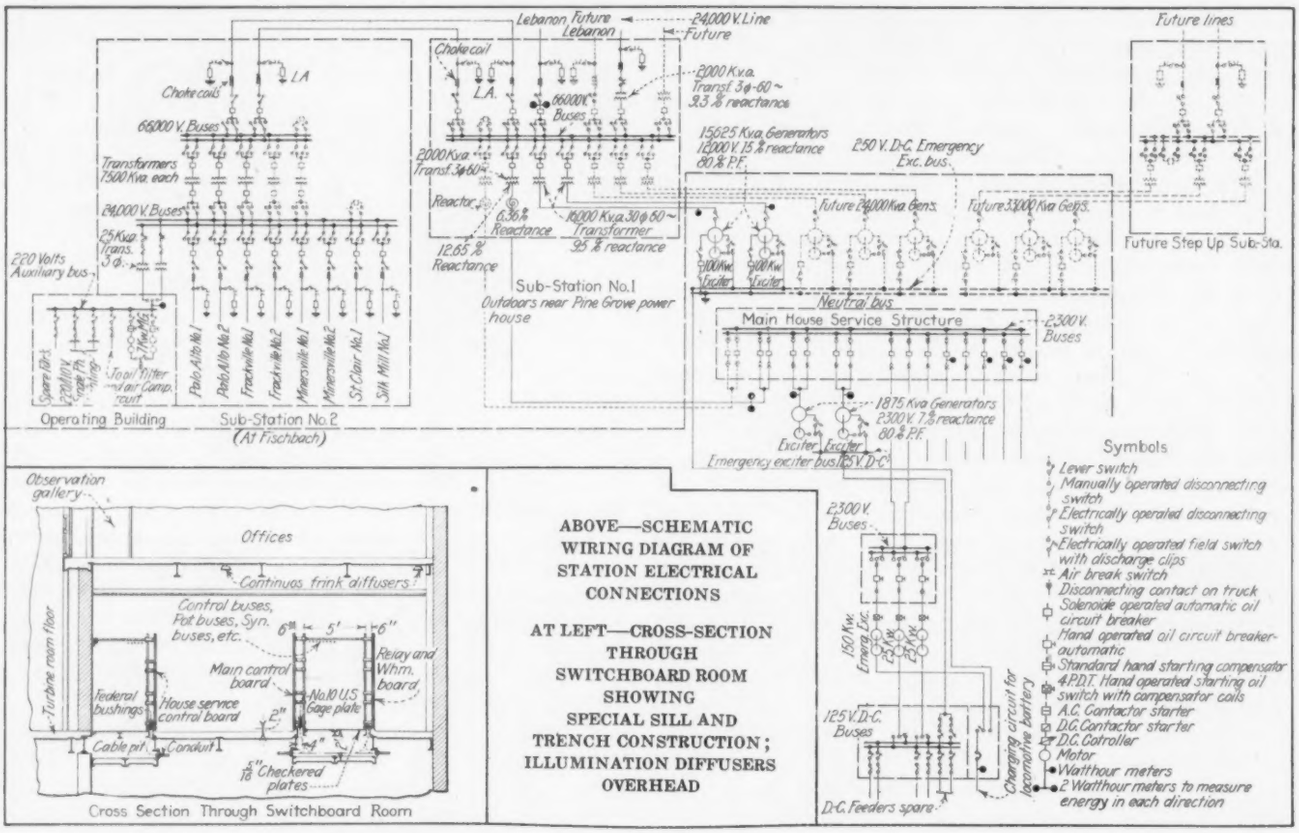
Owing to the fact that there are no automatic oil circuit breakers between the generator and the outdoor main transformer, a particularly safe layout had to be provided for the runs from the generator to the transformer and for the proper accommodation of disconnecting switches, current transformers, potential transformers, etc. The main generator runs in the power house consist of one 3-in. x ¼-in. copper bar per phase, supported on a standard corrugated bus supports and surrounded by wire screening which is removable in sections. Near each generator a jitney bus is provided for phasing out, so that all that is necessary for changing phases is to interchange two short pieces of copper bar. The copper runs continue to a small masonry structure which houses the main generator disconnecting switch, the neutral oil switch and disconnecting switches, as well as all the potential transformers and fuses and some of the current transformers. The main generator disconnecting switches are three-pole, single-throw, gang-operated and of an entirely new design. This new switch can be accommodated in a compartment of minimum depth as well as minimum width, and the doors do not interfere with the operation of the mechanism. Two intermediate barriers of a three-phase cell have small recesses in which a channel iron is moved up and down by means of a screw drive or rack. This channel carries three insulators, one projecting into each of the compartments of a three-phase cell, and each of these insulators carries a switch blade. On the rear wall of the compartment there are two stationary insulators above each other which carry the upper and lower switch clips. When the channel with its three insulators is in its upper position the switch is closed. When in its lower position the switch is open, and the operation can be accomplished with all the doors closed. A similar switch, double-pole, single-throw, is used to disconpect both sides of the neutral oil circuit breaker. From the compartment the bars continue down to a cable splicing room, whence the energy

of each machine is carried to the outdoor transformer in underground cables.

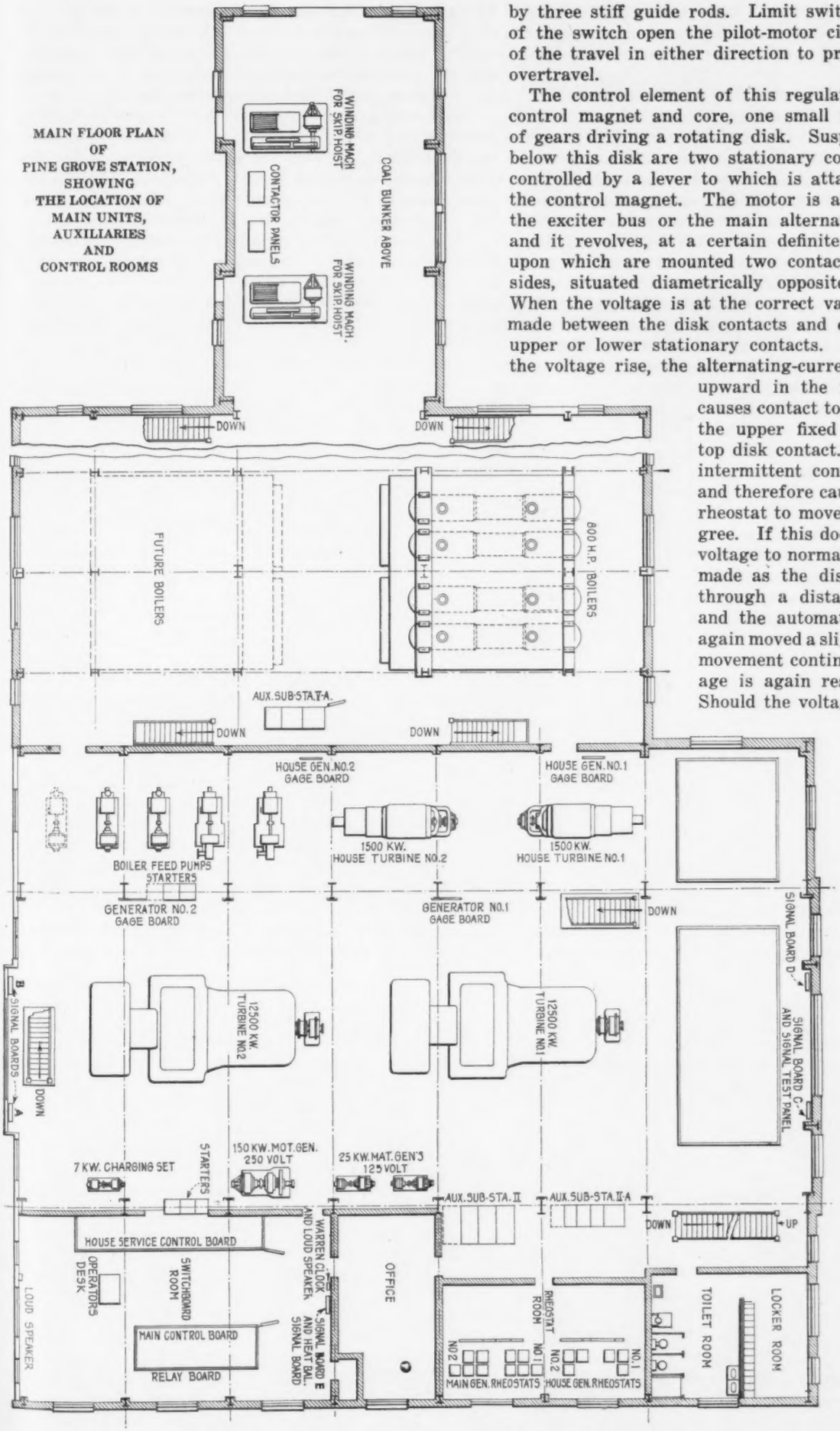
After a thorough investigation it was found to be advantageous to use cable for the underground stretch of approximately 300 ft. between the power house and the outdoor substation for the initial installation. For the future units, however, which will be of considerably greater capacity, it is intended to use bars the full length. For each 12,500-kw. unit (approximately 16,000 kva.) there are provided three three-conductor, 550,000-circ.mil sector cables, paper-insulated, belted type, lead-covered, the insulation thicknesses being $\frac{5}{32}$ in. x $\frac{5}{32}$ in., the over-all diameter being 3.3 in. The cable was tested at the factory at 42,500 volts for five minutes, and after having been completely installed it was again subjected to a test of 34,000 volts for five minutes. The guarantee calls for a further five-minute test at 25,000 volts after the cable has been in service for one year. The cables are run in 4-in. fiber conduit, a spare conduit being provided for each unit. There is a separate duct line with separate manholes as well as a separate splicing compartment in the power house for each unit. Three short lengths of single-conductor cables are spliced on to each end of each three-conductor cable, each of the single conductors being connected to a single-conductor pothead, thus making a total of nine single-conductor potheads for the three-conductor cables of each unit, three of which form a phase and are connected together by copper bars at each end of the run.

The question of excitation and the related one of voltage regulation loom up as quite important when a new power house is planned the ultimate capacity of which is a more or less unknown quantity. The system adopted for Pine Grove consists of a direct-connected exciter on each unit, its capacity suitable for exciting that unit only, and of one emergency motor-generator which can be thrown on any unit. This practically eliminates all heavy exciter switching and bus work, since the bus supplied from the emergency exciter need have only sufficient capacity for exciting one generator. The absence of any operating exciter bus makes it necessary, wherever voltage regulation is required, to provide a separate regulator for each main unit; but for the large units in use now it has in general become common practice to consider each unit as a power house in itself. The rheostat type of voltage regulator, which allows a constant voltage to be kept on the exciter and regulates instead by the field rheostat of the main unit, seems to offer so many advantages over the older type of regulator, which accomplished all the regulation by changing the exciter voltage, that the new type of regulator appears to be more suitable for large plants. Among other advantages are its more rugged construction, the absence of any small and very delicate parts and the possibility of maintaining constant voltage on the exciter, which offers the convenience of being able to supply direct-current auxiliaries from the exciter, particularly from the emergency exciter.

The regulator used at Pine Grove consists principally of two parts, one being the control element, mounted on the control switchboard, and the other the operating element, mounted on the rheostat. The main generator-field rheostat has a vertically arranged 200-point switch, the arm of which is moved up and down on two rugged screws which are driven by a direct-current motor. This motor is operated automatically in either direction by the control mechanism on the switchboard. The rheostat switch is so arranged that a complete travel takes about ten seconds, thus insuring rapid voltage regulation. The switch arm is very rugged, and besides the two vertical driving screws it is supported

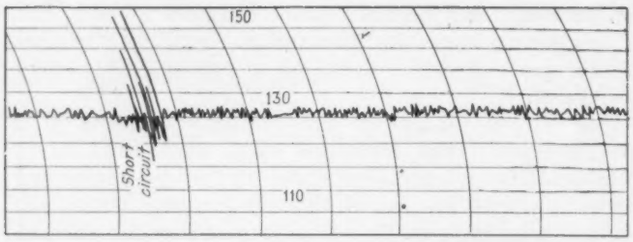


MAIN FLOOR PLAN OF PINE GROVE STATION, SHOWING THE LOCATION OF MAIN UNITS, AUXILIARIES AND CONTROL ROOMS



by three stiff guide rods. Limit switches at each end of the switch open the pilot-motor circuit at the end of the travel in either direction to prevent destructive overtravel.

The control element of this regulator consists of a control magnet and core, one small motor and a set of gears driving a rotating disk. Suspended above and below this disk are two stationary contacts which are controlled by a lever to which is attached the core of the control magnet. The motor is attached to either the exciter bus or the main alternating-current bus, and it revolves, at a certain definite speed, the disk, upon which are mounted two contacts upon opposite sides, situated diametrically opposite to each other. When the voltage is at the correct value no contact is made between the disk contacts and either one of the upper or lower stationary contacts. However, should the voltage rise, the alternating-current core is pulled upward in the magnet, which causes contact to be made between the upper fixed contact and the top disk contact. This is only an intermittent connection, however, and therefore causes the automatic rheostat to move only a slight degree. If this does not restore the voltage to normal, contact is again made as the disk again revolves through a distance of 360 deg., and the automatic rheostat is again moved a slight amount. This movement continues until the voltage is again restored to normal. Should the voltage fall, contact is intermittently made between the bottom disk contact and the lower fixed contact, and the rheostat is moved step by step in the opposite direction until the voltage is again restored to normal. The anti-hunting feature of this regulator is absolutely positive in its action, and there are no vibrating contacts in the regulator. The space occupied by the control mechanism on the switchboard is 14 in. x 16 in. Since being installed this type of regulator has already proved its worth, and even in case of a short circuit on a line carrying a



PORTION OF CURVE FROM CURVE-DRAWING VOLTMETER, SHOWING HOW REGULATORS FUNCTIONED ON OCCASION OF A HEAVY SHORT CIRCUIT

great proportion of the load, it has rapidly restored normal voltage.

Among the drawbacks of this type of regulator are the necessity of providing a great many comparatively heavy cables from the grids to the face plate and the energy loss in the rheostat, but there is no doubt that great improvements will be forthcoming in these directions. The question of using this type of regulator on the exciter field and of eliminating the generator-field rheostat altogether is now being discussed.

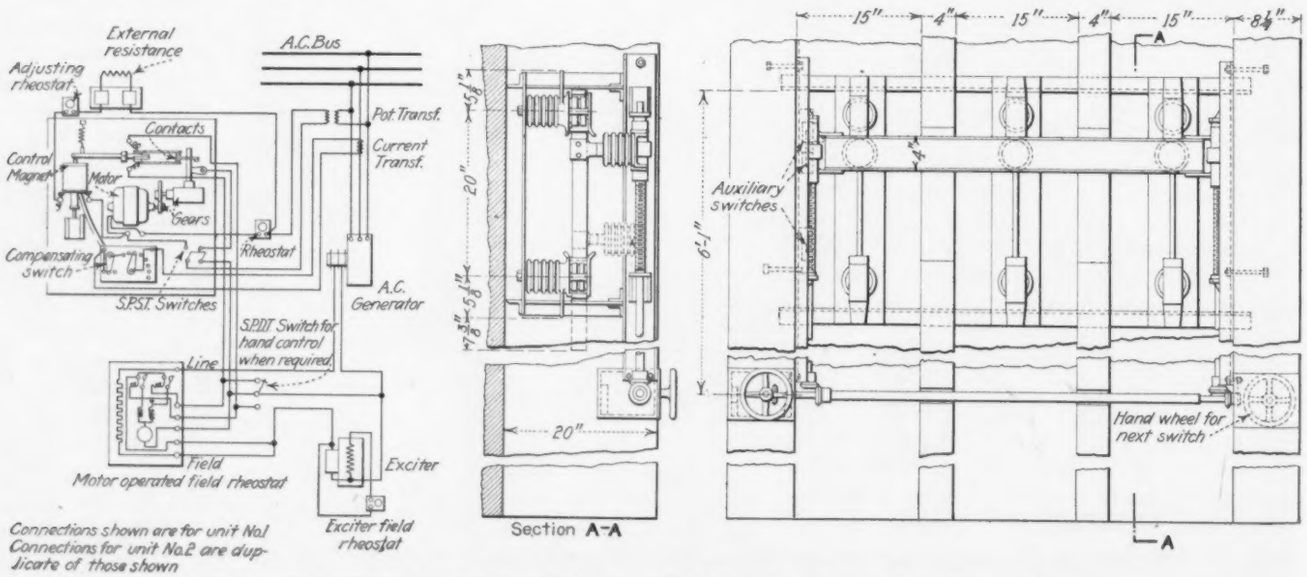
The tendency to reduce the number of operators to a minimum in a power house makes it desirable to have as short a control switchboard as possible. This can be accomplished only by removing from it all contrivances which do not have to be continually within the line of vision of the operator. Recording instruments, relays, testing devices, etc., have no place on the front of a modern control board, and indicating instruments and control switches, with their respective mimic connections, are the only equipment which should be allowed to remain. At Pine Grove the main control board consists of two separate switchboards, arranged back to back, with a 6-ft. aisle between the two. One of these boards is the control board proper, containing indicating instruments and control switches with the respective lamps and mimic buses. The other is called the relay board, and all recording instruments and relays are mounted on it. Opposite each control panel there is a respective relay panel having a similar number. Thus if a generator panel is No. 4, the respective relay panel opposite is called No. 104, an arrangement which allows for easy identification of equipment conduit and cable.

A new type of switchboard sill construction was used which is a considerable improvement over the old type of a 6-ft. channel laid flat. The method consists in making the distance between the panel pipe supports and the back of the panel 6 in. instead of the usual 2½ in. and of providing two separate channels, in their natural structural position, one for the panels and the other for the pipes, leaving a cable slot between these two channels. The same construction is used for the control board as well as for the relay board, and in the space between the two boards there is a cable trench with a concrete bottom and checkered iron-plate top, barriers being provided at suitable intervals. The conduits all terminate in the trench and are not brought up to the switchboard. The slot between the pipe supports and the panels is covered over by No. 10 U.S.G. steel plates, a section for each panel width, which are equipped with "Federal" bushings through which all the control cables are brought up from the trench to the switchboard. This makes it possible to eliminate all unsightly wiring, cable offsets, conduit offsets, etc., on the back of the switchboard. The house-service control board is arranged opposite the main control board. The insert shows the complete switchboard wiring.

The synchronizing is done on the high-tension side by means of the high-tension oil circuit breakers, and in order to avoid the necessity of providing bus potential transformers, the synchronizing is accomplished between generator and generator and not between generator and bus.

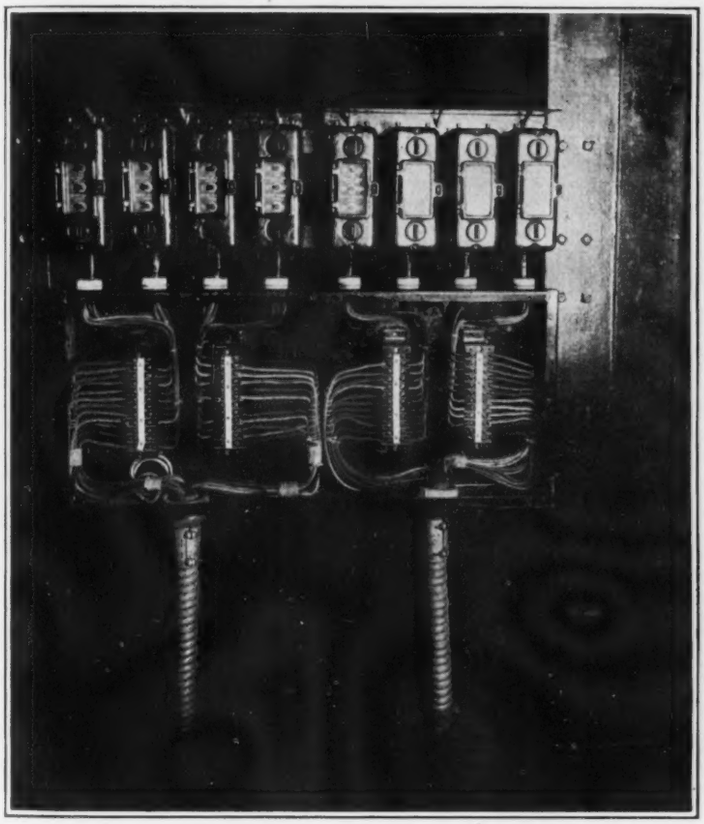
Differential protection is provided across the generator windings and a separate differential protection system across the main transformers. Each of these two differential protection systems will first trip the main oil circuit breaker on the high-tension side of the transformer, which in turn will trip the field switch and the neutral switch. In addition to the differential relays there are overload relays in the generator circuit, which, however, do not trip the oil circuit breaker, but only ring a bell and light a lamp on the generator panel. There being no generator bus, it is possible to have the neutral circuit breakers of all units closed at one time, since there is no possibility of any circulating currents, and all complicated interlocks on the neutral circuit breakers can thus be omitted.

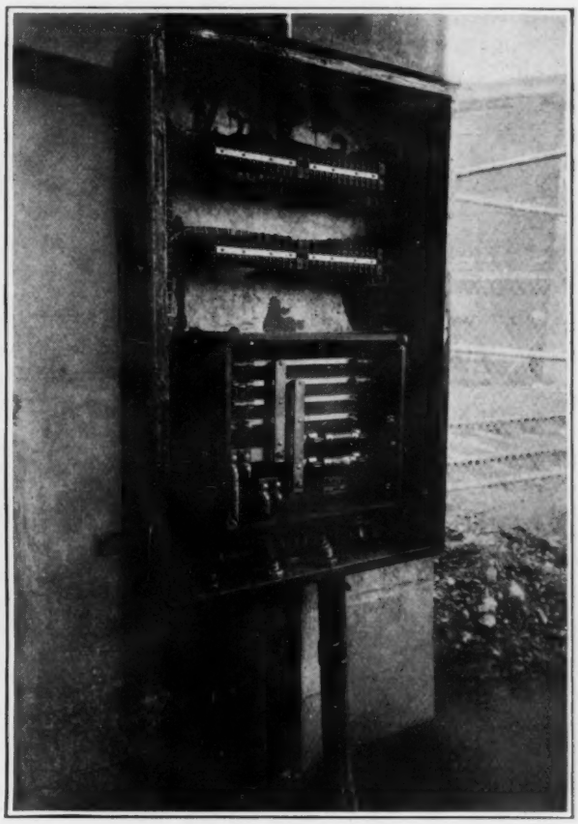
A temperature indicator is provided on the switchboard for each main and house generator as well as for



AT LEFT—CONNECTIONS OF RHEOSTATIC-TYPE VOLTAGE REGULATOR. AT RIGHT—NEW TYPE OF GANG-OPERATED DISCONNECTING SWITCH

each main transformer. On the house transformer circuit frequency relays are provided, which will disconnect the house transformer from the house turbine bus if overspeed of the main units should cause the house units also to overspeed. This disconnection is accomplished before the overspeed device of the house turbine has had time to act on the throttle, which makes it possible to maintain service on the auxiliaries at all times. As a further precaution there are instantaneous low-voltage relays, set for definite voltage, which also will disconnect the house transformer from the house-turbine bus in case of a sudden drop in voltage on the main system brought about by a line short circuit or other cause—thus likewise maintaining service on the auxiliaries.





AT LEFT—GROUP OF VALVE CONTROLS. AT RIGHT—CONTROL CABLE SPLICING BOX

The conduit system is quite simple, for the principal reason that, as elsewhere explained in connection with auxiliaries, there are very few low-tension heavy-current cables in the power house. All control wires running approximately to the same location were combined into one cable wherever possible. For instance, for each high-tension circuit in the outdoor substation which is controlled from the main switchboard there is provided one twenty-five-conductor control cable, each conductor being 19/22, and this cable takes care of all the instrument secondary and control leads of the respective circuits. The required number of four-conductor or five-conductor cables are carried from the switchboard to a junction box on the wall in which they are spliced to the respective conductors of the twenty-five-conductor cables. For the purpose of splicing and to facilitate identification and testing, a new type of terminal splicing block was used (patent pending) consisting of a block of composition insulating material having a number of slots corresponding to the number of wires to be spliced. In each of these slots there is a strip of metal to one side of which is connected one of the conductors of the twenty-five-conductor cables and to the other side one of the conductors of the four-conductor or five-conductor cables. Over the full length of the strip there is a continuous cardboard, ½ in. wide, upon which the identification of the cable as well as the individual wire can be written in ink. Except for the conduits in the basement floor, all conduits are exposed.

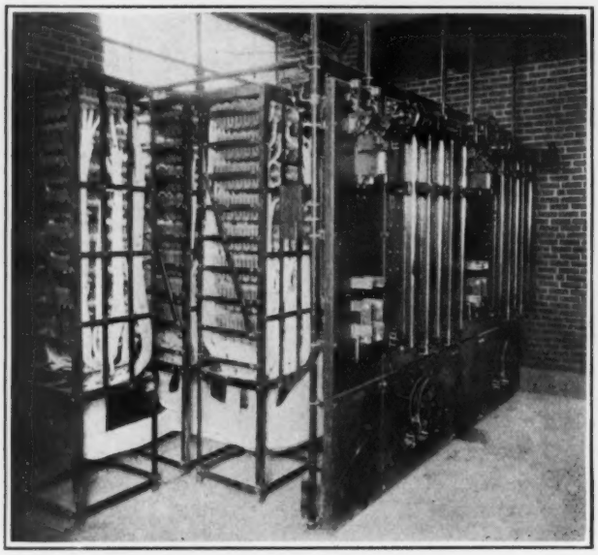
The proper numbering of conduits is very important in a large power house. The best method seems to be that of identifying every conduit and its cable by the panel from which it is controlled, even though the particular conduit does not run to the panel. For this purpose it is very essential to provide a positive numbering system for the various panels, an individual number being assigned to each panel, and even when two or more duplicate panels exist a separate number should be used for each of these panels. It is advisable to use a different hundred for each switchboard. Thus at Pine Grove the control panels of the main control board are numbered 1, 2, 3 and up, and the respective relay panels 101, 102, 103 and up, whereas the panels of the house service control board are numbered 200, 201, 202 and upward. A conduit leaving a certain panel has the panel number and an identification letter. Thus, all conduits leaving panel No. 203 are numbered 203A, 203B, 203C, etc. If conduit No. 203B is interrupted a number of times in its run through the power house, a new letter is assigned to it, after every interruption, it being 203B from the panel to the first junction box, 203BA from the first to the second junction box, 203BB from the second to the third junction box, etc., so that it is not only possible to identify the panel from which the conduit is controlled, but likewise the number of interruptions it was subjected to before reaching a particular point.

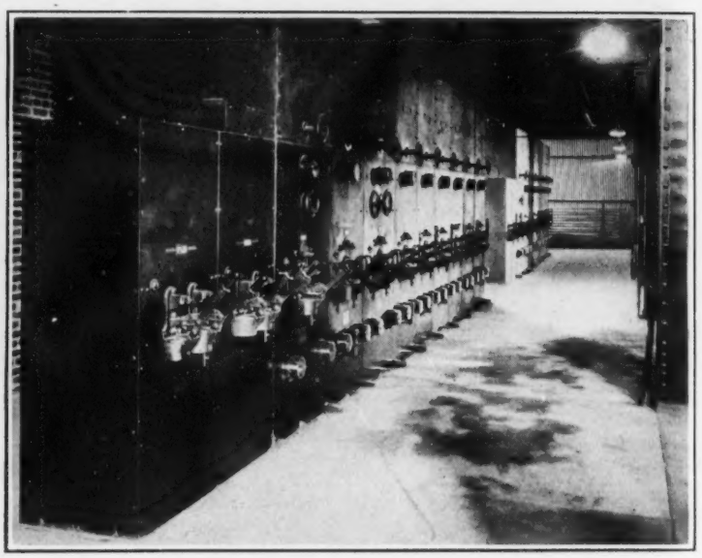
The grounding of the generator neutral is done without a resistor, two 500,000-circ.mil bare cables in parallel running from the neutral bus and connecting to all the intake circulating-water pipes. For apparatus ground one 2-in. x ¼-in. copper bar is provided under the main floor, connected to the building steelwork and to the generator neutral, it having been considered a rather unnecessary procedure to separate various grounds from each other, particularly when very good positive grounds with practically no resistance can be provided throughout the whole power house.

There being no main switching of any importance, the arrangement of the electrical bay is rather simple. On the basement floor are installed some auxiliary substations for motor control, the cable splicing room for the main cables, a room containing small power and lighting transformers, and a room to be used in the future for a high-tension test room. The last named room extends the full height from the basement to the turbine-room floor. On the mezzanine gallery are the two rows of main house-service buses in their steel housings with the respective trucks containing solenoid-operated switches and having a monorail over the aisle between the two rows of trucks for handling purposes. On this gallery is likewise the small masonry bus structure containing the generator switching equipment, the storage battery room and telephone equipment, as well as some auxiliary switching of minor importance. On the main turbine-room floor are the switchboard operating room and an adjoining office, a separate room containing the main rheostats and face-plate regulators, auxiliary substations for operating turbine-floor auxiliaries and locker room. Above the main floor there is an additional gallery which is used for offices and laboratories. A walkway is provided for the full length of this gallery facing the turbine room.

The lighting of power houses often does not receive sufficient thought, and it may be of interest to show what excellent results were obtained at Pine Grove by very simple means. The main turbine room is illuminated by means of Benjamin units No. 6060, installed high up between the roof trusses, approximately 44 ft. above the floor line, spaced 31 ft. x 31 ft., and each containing one 1,000-watt unit. The offices are equipped with overhead Holophane units No. 2120VF, and similar Holophane units on brackets are provided in the bay between the turbine room and boiler house which contains the house turbines and boiler-feed pumps. The rest of the illumination is done by means of "RLM" reflectors of various sizes. The effect throughout is surprisingly good; there is no glare anywhere and there is ample illumination everywhere, with hardly a fixture conspicuous. Special attention was given to the switchboard room, which is illuminated by two continuous rows of Frink diffusers, giving the effect of a skylight, but with the advantage of almost uniform vertical illumination of approximately 5½ foot-candles.

The distribution to the various cabinets is quite simple, two sets of three-phase lighting transformers being provided for the turbine room and two separate sets for the boiler house, thus eliminating long feeds. These transformers are three-phase, and each of the two sets supplies a distribution switchboard, one in the turbine room and one in the boiler house. On each of these switchboards there are two sets of three-phase, 110-volt buses, from which double-pole switches supply energy to each of the lighting cabinets, which are equipped with three-phase buses and single-phase branches. For emergency lighting there is an automatic switch on the battery board. This is normally open, but closes automatically when the alternating-current supply fails, and reopens automatically when the alternating-current is again available. This switch supplies a number of emergency lighting units independent of the main lighting system and scattered throughout the turbine room and electrical galleries. A similar automatic emergency lighting switch is provided in the boiler house.





AT LEFT—RHEOSTATS FOR A MAIN UNIT AND A HOUSE TURBINE. AT RIGHT—NIGHT VIEW OF AUXILIARY SWITCHBOARD

The turbines as well as the principal switching apparatus and special regulators were furnished by the General Electric Company, the special disconnecting switches by Schweitzer & Conrad, Inc., the 15,000-volt bus supports by the Electric Power Equipment Corporation, the signboards by Charles Cory & Sons, Inc., the special switchboard lighting by I. P. Frink, Inc., the main high-tension cables by the Standard Underground Cable Company and the control and auxiliary cable by the Simplex Wire & Cable Company. Lighting cabinets and conduit fittings were supplied by the Crouse-Hinds Company.

The power house was designed and constructed by the J. G. White Engineering Corporation.

Electragists Find Appliance Discounts Inadequate

Committee Analyzes Distribution Problems, Proposing Plans for Consignment Stocks and Deferred Compensation

BY W. CREIGHTON PEET
Chairman Merchandising Policy Committee, Association of Electragists International, New York City

AT THE annual convention of the Association of Electragists held in Washington in October, 1923, the following resolution was passed:

"Be it resolved, That the convention having shown such a marked interest in the subject of mechandise distribution and compensation for services rendered, it is recommended that the president appoint a special committee of three, from the floor, to make a study of these two subjects and report its findings to the executive committee at its next meeting."

Manufacturer, wholesaler, central station and contractor-dealer—all have an important and necessary place in the process of distribution, and each interest must recognize the interests of the others and make due provision for all points of contact, or constant friction and dissatisfaction will continue.

The right of all of the several factors in distribution to sell to whomever they please is undisputed, just as the right of all of the several factors to buy where they please must be accepted, but if in asserting this right any one of the factors ignores the functions of the other groups upon whom they look for a continued performance of service throughout the greater part of distribution, they are breaking down the incentive of the other groups to give that service, and distribution and service to the public suffers.

DISTRIBUTION PROBLEMS ANALYZED

Several definite problems of unbalanced distribution were presented to the committee which it has attempted to analyze. Taking up each of the problems, the committee presents the following facts for consideration by the industry:

1. That manufacturers and wholesalers are selling direct to consumers materials and equipment that require the functions of the electrical contractor to install, placing the burden of responsibility for satisfactory operation on the contractor, through whom in the normal course of business the sale should be made.

2. That manufacturers and wholesalers are selling direct to consumers materials and equipment to be installed by the consumer, where the consumer is not competent to make such installation.

3. That wholesalers, receiving a maximum differential on all goods handled by them, such discount being designed to be divided between themselves and the retailer, are using that maximum discount to perform only a retail service on a part of their sales, thus setting up false standards for the basis on which actual retail business can be operated at a profit.

4. That many jobbers are extending lines of credit to contractors and dealers not commensurate with the responsibility of such customers, thereby encouraging speculation by inexperienced men and creating an unfair and an uneconomic competition that is demoralizing to the established and responsible business.

5. That lack of definite sales policies on the part of the larger manufacturers and jobbers and their salesmen is responsible for a lack of confidence on the part of the contractors and retailers.

6. That the margins of discounts to retailers on many lines of goods, especially appliances, are insufficient to cover the cost of adequately serving their communities and leave a fair compensation; and

7. That such insufficient margins of discounts to retailers on many lines are encouraging those who can do so to seek wholesale discounts on various pretexts, thereby still further upsetting the balance of distribution through an unequal compensation.

Two systems of merchandise distribution were presented for the consideration of the committee as answering some of the problems of retail distribution today, and these the committee presents at this time for further study by the industry.

CONSIGNMENT PLAN

The first is the adoption of the "consignment plan" for handling all appliances from manufacturer through the jobber and retailer to the consumer, a plan similar to the lamp distribution plan.

The advantages of this plan are, first, the ability to establish fair prices at which all sales are made to various classes of customers, and, second, the certainty of an equal compensation for the same kind of service rendered under similar conditions for all distributors.

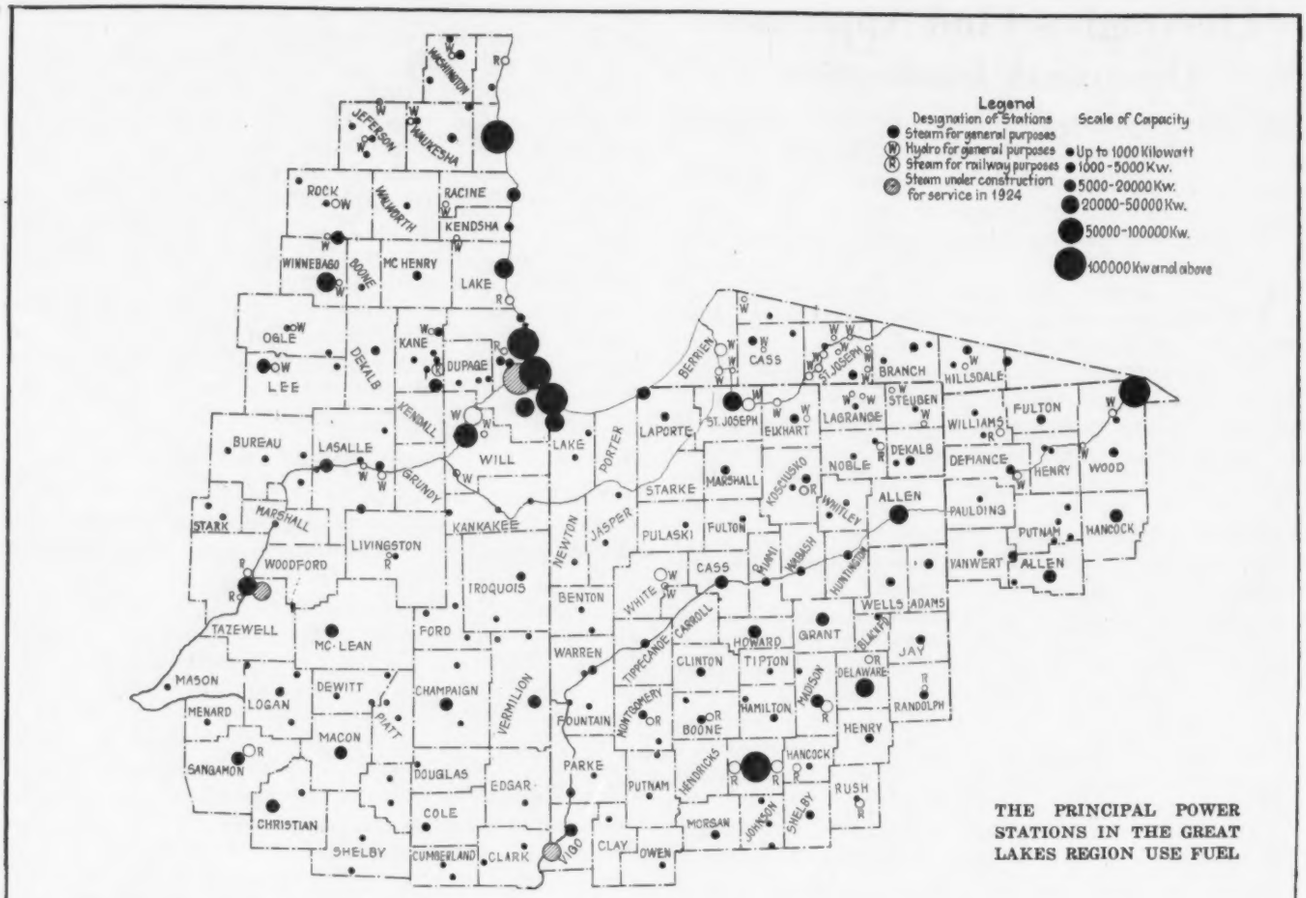
The objections are the practical problems of financing such tremendous volumes of consignment stocks and the problems of intricate accounting which would result from the keeping of consignment stock records on the many lines handled. If the consignment plan is the answer to many of the distribution ills of today, doubtless practical solutions of the financing and accounting problems could be found by each individual manufacturer for his lines, just as the lamp manufacturers have established their distribution methods. Study is needed as to the effect of this plan on individual initiative and creative ability if applied to all classes of merchandising.

The second plan presented may be termed the "deferred compensation plan." Under such a plan the manufacturer would establish one discount to all classes of distributors for an equal amount of business, whether jobbers, central stations, contractor-dealers or dealers, and an additional compensation for jobbing service, i.e., for distribution of the manufacturers' goods to the retailer for resale would be given only when that function is actually performed and the original compensation has been passed on to the retailer.

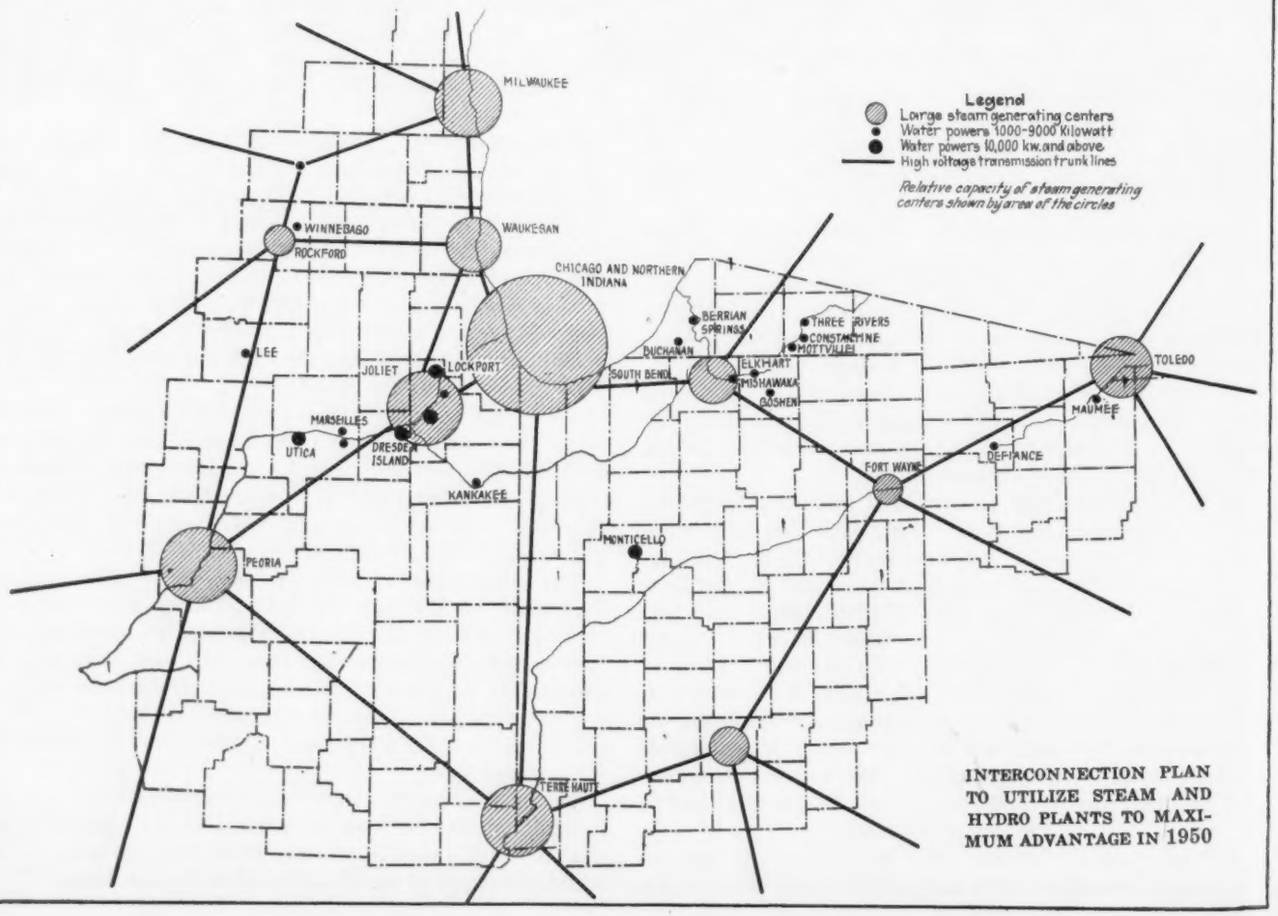
This plan requires that every distributor, whether jobber or retailer-jobber, should keep separate accounts of retail and jobbing business. Such a plan would encourage the actual physical separation of jobbing and retailing, or at least separate cost accounting, and bring nearer the much to be desired result.

The retail counter in a jobbing house sets up false standards of the cost of both jobbing and retailing, creating an overhead for the jobbing business that demands differentials higher than are necessary for an exclusively wholesale business, and giving the impression that retailing can be conducted on margins below the true cost of adequately serving the communities with retail stores.

The above, constituting the preliminary report of the special committee, was prepared in the earnest hope that it would produce an industrial consciousness of the many problems in merchandise distribution today.



THE PRINCIPAL POWER STATIONS IN THE GREAT LAKES REGION USE FUEL



INTERCONNECTION PLAN TO UTILIZE STEAM AND HYDRO PLANTS TO MAXIMUM ADVANTAGE IN 1950

Middle West Power in 1950

Survey for Part of Great Lakes District Completed—Main Reliance Will Be Steam Plants Connected by Transmission Systems—The per Capita Consumption in 1950 Expected to Be 1,760 Kw.-Hr. per Annum

THE study undertaken by the Great Lakes Geographic Division, National Electric Light Association, in co-operation with adjacent divisions to determine the economic and engineering development necessary to the territory up to 1950 has gone forward. Preliminary work has been done on the whole territory shown on the map, and the complete report is now available on the area A on map.* The power survey committee has endeavored to co-ordinate the extensions of all systems in the area so that developments will occur in the manner that will best utilize the resources for economical power production. The committee believes that 60 cycles is accepted as the standard frequency for American systems and that many miles of transmission lines at 33,000 volts, 66,000 volts, 132,000 volts and even higher voltages will be used in the territory considered, with most new extensions of high-tension lines built at 66,000 volts or 132,000 volts. The definite year in which conditions will warrant the developments considered is unimportant in the committee's mind.

TABLE I—STEAM AND WATER POWER IN AREA A—1923

Portion of Area A in	Steam Power Capacity, Kw.	Water-Power Capacity, Kw.	Total Capacity, Kw.
Wisconsin	197,390	2,865	200,255
Illinois	1,054,719	33,925	1,088,644
Indiana	391,914	14,935	406,849
Ohio	184,650	7,150	191,800
Michigan	5,192	16,465	21,657
Total	1,833,865	75,340	1,909,205

The population in the area A was 8,600,000 in 1920 and is expected to increase to 12,940,000 in 1950, an increase of 51 per cent. The rate of increase in the population of the Great Lakes division for the next three decades is estimated at 13.3 per cent, 11.8 per cent and 11 per cent respectively. Ninety per cent of all industrial power in area A and all of the power required by urban and interurban railways will be supplied from the central-station systems. Railroad electrification will probably have progressed to include all the terminals in the Chicago district and perhaps the divisions terminating in Chicago. Electrification of rural districts will reach a stage equal to that at which intensive experimental work along this line has been done, and the energy demand will be approximately 5.8 kw. per square mile of farm. Resident consumption is expected to average about 650 kw.-hr. per family per annum, with load factor around 9 per cent, or a demand per family of 0.5 kw. Small business lighting and power will have average demands in different localities varying from 0.3 kw. to 2 kw. per customer, with load factor approximating 25 per cent. Street lighting will require 5 kw. to 12 kw. per 1,000 inhabitants, and operate with a load factor of 43 per cent. Coal mining will require from 2.5 kw.-hr. to 3 kw.-hr. per ton produced, with a load factor of about 25 per cent. Oil production, drainage, pumping and quarrying will have load factors around 15 per cent. The annual consumption in 1950 may be expected to range from 500 kw.-hr. per capita in rural districts to nearly 3,000 kw.-hr. per capita in the cities.

*"Report on Area A, Electric Power Survey Committee, Great Lakes Division, N. E. L. A.," R. F. Schuchardt chairman.

AREA COVERED IN THE GREAT LAKES POWER SURVEY

Table I shows the existing steam and water power in area A, and Table II shows the predicted power consumption in area A about the year 1950. Fig. 1 shows the arrangement of generating centers and trunk lines to meet the anticipated energy requirements in the region in 1950. The total consumption in area A in 1950 will be greater than 22,700,000,000 kw.-hr., requiring a generation of about 27,000,000,000 kw.-hr. and giving a coincident demand of 5,700,000 kw. This will be a per capita consumption of 1,760 kw.-hr. per annum, with a corresponding generation of 2,100 kw.-hr.

TABLE II—FUTURE POWER CONSUMPTION IN AREA A

(Estimated power consumption of area A about the year 1950)

Service	Consumption, Kw.-Hr.	Per Cent of Total	Kilowatt-Hours per Capita
Residence service	2,019,000,000	8.86	156
Business service	2,071,900,000	9.09	160
Municipal lighting, pumping, etc.	1,082,200,000	4.75	84
Industrial power	11,399,300,000	50.03	881
Mines and quarries	269,800,000	1.18	21
Electric railways	1,613,200,000	7.08	125
Electrified railroads	1,500,000,000	6.58	116
Drainage pumping	18,300,000	0.08	1
Agricultural power	313,500,000	1.38	24
Other uses	2,500,000,000	10.97	193
Total	22,787,200,000	100.00	1,761

FORM 586

BALANCES OF CLASSIFIED STORES

STOREROOM

DESCRIPTION — REFER TO MR.

MAX. — SYMBOL

MIN. — MAKER'S NO.

STORES ORDERED AND RECEIVED—1

Date Ordered	Quantity Ordered	Date Placed	Order No	Bought of	Price	Per	Discount	F. O. B.	Date Received	Quantity Received

STORES APPORTIONED—2

Date Apportioned	No. of Pieces or Quantity	WORK

STORES ON HAND IN STOREROOM—3

Date	Order No	No. of Pieces or Quantity	Cost	Per	BALANCE VALUE
	Brought Forward				

STORES ON HAND IN STOREROOM—3

Date	Order No.	No. of Pieces or Quantity	Cost	Per	BALANCE VALUE
	Brought Forward				

FIG. 1—CONTROLLING CARD RECORD USED IN THE BALANCE-OF-STORES SYSTEM

FORM 559

REQUISITION ON STORES DEPARTMENT

Portland Railway, Light & Power Co.

DEPT REQ. NUMBER

45202

TO — Storekeeper No.

CAR NO. / WORK CODE	BALANCE ON HAND	STORES TAG	BALANCE OF STORES	COST DEPT.

CONTROL ACCT.	SHOP ORDER OR JOB NO	ACCOUNT: ESTIMATE / WORK ORDER	PREFIX	NUMBER	SUFFIX	CONST. CLASS

SYMBOL	QUANTITY	MULTIPLIER	COST PER		TOTAL

DESCRIPTION

MAT. CODE NO.

RECEIVED ARTICLES ABOVE	DATE / /	SIGNED	DATE / /

PATENT APPLIED FOR PACIFIC MANIFOLDING BOOK CO OAKLAND CALIF 5234

FIG. 2—REQUISITION ON STORES DEPARTMENT; ONLY ONE ITEM IS ORDERED ON A REQUISITION

Balance-of-Stores Accounting System

Overstocking or Understocking Is Eliminated by This Method — System Shows Stores on Hand and on Order — Maximum and Minimum Stocks to Be Carried Are Specified by Utility Department Heads

By I. D. MURFIELD
Portland Electric Power Company, Portland, Ore.

A SYSTEM of stores accounting, commonly known as the "balance-of-stores system," which provides for the carrying of a maximum and a minimum quantity of every item of stock, has been in use for a number of years by the Portland (Ore.) Electric Power Company (formerly the Portland Railway, Light & Power Company). The inauguration of the system resulted in a large reduction in the amount of money tied up in the supply account and a reduction of the stock carried to about 50 per cent of what it was under the old plan of stock-keeping. An important feature of the system is that it places the responsibility for the amount of stock carried directly on the department head using it, by requiring each man to specify the maximum and minimum quantity to be carried. This not only prevents overstocking, but, what is perhaps equally as important, it avoids the depletion of stock of any item.

In brief, the stores system provides:

(a) A complete record of stores on hand.
(b) A complete record of stores on order.
(c) A complete record of stores apportioned.
(d) A complete record of stores available.
(e) A complete record of stores issued.
(f) A record of maximum and minimum stock to be carried.
(g) A record of consumption of each item during any period.
(h) A symbol system for stores that readily locates material in the storeroom.

The system is based upon the classification of all materials into divisions and groups according to the nature of their use. For example, all material adapted to a specific use, such as railway-car motors, controllers and their repair parts, constitutes one division. All parts pertaining to repairs and maintenance of the car trucks are classified in another division, and so on until all materials used for definite purposes are listed under their proper divisions. Materials usable in all branches of the company's work, such as general hardware, are carried in a division known as "hardware general." Items such as fuse plugs, friction tape and miscellaneous electrical material are listed in a division known as "electric insulating material." Paints, oils, etc., are listed under a heading by the same name. In all, the stock is divided into twenty separate divisions.

Bulletins Covering Stock.—Each division of stock is covered by a bulletin, and each department head is furnished with a set containing a complete list of all materials used in his department, and a complete set is kept on file in the office of the balance-of-stores clerk covering the entire stock. The reason for this is the fact that all department heads are responsible for the quantities of each article carried for their particular needs, based on a maximum and minimum (see Fig. 4). The combined total maximums and total minimums reported by the various department heads are carried in the set of bulletins retained by the balance-of-stores clerk, and from this set of bulletins the maximums and minimums are placed on the stores cards.

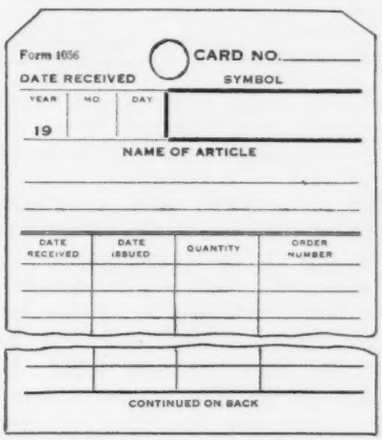


FIG. 3—BIN TAG WHICH ALWAYS SHOWS STOCK ON HAND

A balance-of-classified-stores card (Fig. 1) is the controlling record and gives full information at all times regarding the item in question from the time of order to the date received and disbursed for use. All requisitions, credit memos., receipts and transfers are posted daily on these cards.

The bin tag (Fig. 3) hangs on the bin where the material is stored, and when any stock is drawn from or placed in the bin the amount must be entered on the tag, subtracting or adding the quantity and bringing forward the new balance. The job number is also shown.

Requisitions (Fig. 2) issued from a department requiring material show date, quantity, full description, the proper account chargeable and the signature of the

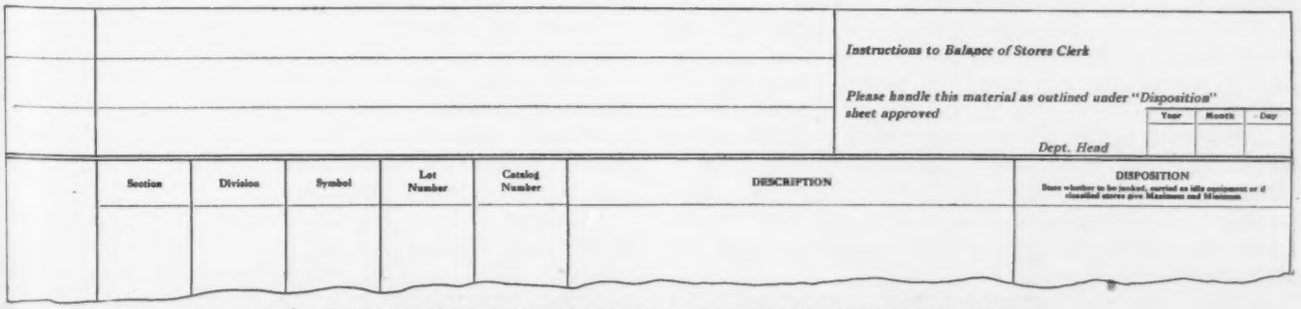


FIG. 4—STOCK BULLETINS SHOW MAXIMUM AND MINIMUM STOCK TO BE CARRIED

FORM 8

PORTLAND RAILWAY, LIGHT & POWER CO

Order No._____ Reg No._____

Requisition on Purchasing Dept. only

Date_____ 19___

Ship to_____ Address_____

Charge_____ Wanted_____ Promised_____

Ordered from_____ Address_____

Route_____ F O B._____

QUANTITY WANTED	SYMBOL	DESCRIPTION OF MATERIAL	MAX	MIN	ON HAND	WEIGHT	LAST ORDER NO.	AVERAGE USED PER MONTH	PRICE QUOTES
		MATERIAL CHARGEABLE TO ONE ACCOUNT ONLY							DO NOT WRITE HERE

Approved by_____ Approved_____

Approved by_____ Approved by_____
Purchasing Agent

Ordered by_____

FIG. 5—FORM OF REQUISITION USED ON PURCHASING DEPARTMENT FOR OUTSIDE ORDERS

man authorized to sign requisitions. The storeroom clerk upon receipt of the requisition either issues the material called for to the man presenting the order or, in case it is to be sent out, places it in delivery bins plainly marked to show just whom the goods are for and the job number for which they are to be used. If the storeroom clerk has time when the material is issued, he enters the amount, the account charged and the date on the bin tag (Fig. 3) and subtracts the amount issued from the amount on hand, showing the balance on the bin tag. He then copies the symbol of the material from the bin tag to the requisition and shows the balance on the requisition, initialing it in the place provided for that purpose. In case the storeroom clerk has no time at the moment for posting to the bin tags, the requisitions are placed on files marked "not worked," and later in the day these requisitions are picked up and the amounts posted on the bin tags. Not more than one item is ordered on one requisition. This gives the greatest flexibility possible and makes it convenient to assemble all requisitions covering an article that is issued many times during the day.

Each day as the requisitions are filled by the men in the warehouse and completed they are turned into the storeroom office, and it is the duty of the office clerk to arrange them in proper order according to symbol and balances. At a certain time each day they are forwarded to the balance-of-stores clerk.

When the requisitions are received by the balance-of-stores clerk, the symbols and balances are first checked, and if found correct, they are priced, extended and posted on the cards, carrying forward the balance in quantity and money. The money-value postings on the stock cards are then checked against the sum total of the money value on the requisitions, and the two must balance. The requisitions are then initialed by the clerk and forwarded to the cost department for distribution to the accounts.

Credits and Transfers.—Credit memoranda for "removed" and "unused" material are handled by the storeroom and the balance-of-stores clerk in the same manner as a stores issue, except that the entries are all credits, on the bin card, the credit memo. and balance of stores card. A transfer form is used when transferring material from one supply account to another.

Replenishing Stock.—All ordering of supplies for stock originates in the office of the balance-of-stores clerk, who is governed in his requisitions by the maximum and minimum as shown on the stock card.

When the last balance as shown on the stores requisition sent in, corroborated by the balance as shown on the stock card, is down to or near the minimum given, a requisition on the purchasing department (Fig. 5) is written in duplicate for the maximum amount, giving the date, symbol, description and last order number. The last order number is for the information of the purchasing department for reference purposes in buying. The original order is then sent for approval to the department head responsible for the maximum and minimum. The duplicate remains with the balance-of-stores clerk as a follow-up order. These orders carry a department serial number. When the department head receives the order for his "O.K." he knows the stock has reached the minimum, and if he cares to change the article for another of later type more suitable for his work, he does so, signs the order and returns it to the balance-of-stores clerk in order that the stock-card description may be corrected accordingly. It is then turned over to the purchasing department for ordering.

Orders for materials used by all departments, such as nails, miscellaneous bolts, cut washers, etc., where the maximum and minimum is the combined total requirement of all departments, are placed directly with the purchasing department for order. Such orders are subject to any changes deemed necessary to facilitate buying to the best advantage.

Purchase Order.—Requisitions for purchase are made up in quadruplicate for all local orders. For orders placed outside the city where freight is involved an additional copy is made. The original copy (white) goes to the firm with which the order is placed. The

duplicate (buff color), together with the order on the purchasing department, is filed in the open file in the purchasing department. The triplicate copy (pink) is sent to the storekeeper and is filed by him under the firm name pending delivery of the goods. The fourth copy (blue) is handed to the balance-of-stores clerk. From this copy the information is posted on the stock card (Fig. 1), filling in the date when the order was placed, the order number, name of firm on which placed, prices quoted, discounts allowed and shipping data. The purchase order number and date are checked on the duplicate copy of the order on the purchasing department. This completes the order file and shows that the order has been placed. The fifth or additional copy, as previously explained, is sent to the traffic bureau for tracing shipments, routing data, etc.

Receipt of Material.—Upon receiving material at the storeroom the receiving clerk checks the items against the purchase order and makes out a receipt in duplicate for each item, showing date received, stores symbol, quantity received, description, purchase order number and any information having a bearing on the final payment of the invoice. The duplicate copy of receipt is filed by serial number. The receiving clerk then places the material in the bin and enters on the bin tag (Fig. 3) the date received, the quantity received, the new balance and the purchase order number.

The new balance on hand is then filled in on the receipt and initialed by the receiving clerk. The original receipt is then signed by the storekeeper and sent to the balance-of-stores clerk, upon receipt of which he enters the data on the stores card in the proper columns, initials same and sends it to the purchasing department invoice clerk.

Invoices.—The invoice clerk matches the receipts against the invoices, and if found correct, hands the receipts with the invoices attached to the balance-of-stores clerk for posting the money values on the stock cards. The invoices are then stamped, showing the correct supply account distribution, and forwarded to the purchasing agent for his signature. From the purchasing agent they are sent to the auditor. The auditor upon receipt of invoices properly indorsed by the purchasing agent passes upon the transactions, and if "O. K." in his opinion, has a voucher issued.

Stores Symbol.—A mnemonic system of symbols is used, which requires that supplies be arranged in groups, such as: SR—stores railway, SE—stores electric.

Each group is further subdivided, the division being from the general to the particular; that is, each division subdivides the one it follows, as: SRE—stores railway electric, SEL—stores electric line material.

For illustration, under the SEL group—stores electric, line material—poles are a subdivision of line material and a wooden pole is a certain kind, hence the symbol SELP-W. Using the length between P and W gives SELP-40W, the symbol for a 40-ft. wooden pole. The mnemonic system requires considerable work and time to prepare and apply, but its flexibility and the ease with which it can be memorized once it is adopted are very helpful.

PERPETUAL INVENTORY

A distinct advantage of the balance-of-stores system is its perpetual inventory feature. The requisitions, credit memoranda, receipts, transfers and all other forms are issued on a single-item basis. Each form shows the balance on hand after each transaction and makes it possible to count any item desired at any time. This work is assigned to a man from the balance-of-stores clerk's office who is kept busy every day in the warehouse counting materials, reconciling the records with the actual quantities found, reporting his findings daily to the balance-of-stores clerk on a special inventory sheet showing bin-tag balance, actual stock balance and the difference accruing.

This system of stores accounting may at first appear to be complicated, but its many advantages over other methods of stock keeping merit its consideration for utilities both large and small. There are four specific advantages to be expected from such a system, all of which the writer's company has derived. They are: (1) A decrease in the amount of stock carried; (2) speed and dispatch in handling issues from the storeroom, owing to the standardization and proper location of stock; (3) a saving in the cost of purchasing due to the checking of all requisitions against the stock records before an order is placed, and (4) the existence of only one system for the placing and receipt of all orders for material or supplies.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Two Sides to the Story of the Salesman and the Executive

To the Editors of the ELECTRICAL WORLD:

Scott's recent article, "Capitalizing on Salesmen s Visits," is very interesting, but it only tells one side of the story. Perhaps the other side will be of as much interest to the salesman. I have so often had a perfectly good day's work interrupted and hours of time wasted through the visits of salesmen, and have so many times been on the verge of establishing an ironclad rule and posting a sign "No salesmen admitted," that Mr. Scott's article tempts me to give you this viewpoint. The only reason the salesman is so often dodged by the executive and allowed to see only the purchasing agent is that he does not tell his story when he gets the opportunity, or perhaps he has no story to tell.

I well remember one young man who called on me regularly for almost a year before I learned what he had to sell. I learned his name, learned whom he was traveling for, what he thought of the weather, the baseball games and the town, but never a message. This example is not so extreme as one might at first think. In the very example cited by Mr. Scott I'll bet an even dollar that this salesman who had been "calling at his plant for ten years" had spent very few minutes, if any, telling the story of this particular device. The chances are that when it was finally purchased some one had to call him up and get him to come over and "sell" it to them.

A salesman who will get down to business and tell me what he has to sell and advance some logical reasons why I should purchase his wares is always welcome. But unfortunately so many of the men who call on me are trying to pave the way, sell their personality, or perhaps do something I do not understand. They are men without a message who take up my time and teach me to shunt all salesmen onto the purchasing agent.

Springfield, Mo. R. E. THOMPSON.

Central Station and Industrial Practice

Flashover Difficulties in Rotary Converters

By E. S. Howe
Manager Service Department Cia Westinghouse Electric International, Mexico City, Mexico

TWO rotary converters in a substation near Mexico City gave trouble for a year or more by flashing over every day or two and sometimes a number of times in one day. The writer was asked to investigate the trouble, and he proceeded to make an analysis of all possible sources from which it might arise. Data were asembled from three sources—the railway company, the electric power company and the substation operator's records. The case is interesting because when all apparent and visible connections and conditions had been checked and found correct the trouble still remained.

A quick examination showed no condition manifestly wrong. Then, to protect the machines from further flashovers, preventive resistance and reactance were placed in the circuit between the machine and the source of trouble. "Outside" and "inside" protection were instituted simultaneously.

The first of these consisted in moving all feeder taps to the trolley wire to a distance of at least 5,000 ft. from the substation, so that at least a mile of feeder wire would always be in circuit between the point of trouble and the rotary converter. If this had not been enough, as was shown to be the case by trial, reactances would have been placed first in the direct-current feeders just behind the switchboard and then later in the high-tension supply lines.

The second or "inside" plan of protection consisted in building up the internal reactance of the machines by operating them with a higher field strength. The voltage had been maintained at 560 because the manufacturers would not guarantee their street-car motors if operated at a higher voltage than 560. It was found by actual measurement on the cars that 560 volts would not be exceeded with 565 volts at the substation busbars, and so the latter voltage was immediately adopted, with the result that for three days no flashover occurred. That showed that work was progressing on the right track but had not gone far enough. A new method was therefore adopted to increase the field strength. The step-down transformers for each rotary were opened and the low-tension taps were changed to taps giving 3 per cent less voltage on the rings of the converters. Then by means of a stronger field than before the voltage was brought up to 565 again.

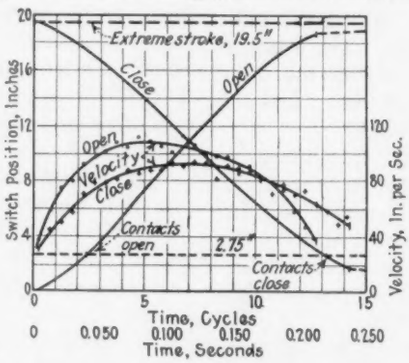
With these changes the field rheostats were three-quarters cut out and the low-load power factor was raised considerably, while at full load it had passed through unity and become slightly leading. From then on the rotary converters operated satisfactorily, no more trouble being experienced.

Timing the Operation of Oil Switches

Apparatus Determines Distance Moved During First Few Cycles After Separation of Contacts

By Clifford W. Bates
Research Engineer Philadelphia Electric Company

IN ORDER to determine the exact movement of the contacts of oil switches as they are opening the Philadelphia Electric Company has developed an apparatus which is in effect a graphic cycle counter. It consists of an ordinary electric buzzer the vibrating armature of which is fitted with a pencil point. The buzzer is mounted on a steam-engine indicator from which the pressure-recording parts are removed and which has a self-contained reducing mechanism. The interrupting contacts of the buzzer are also removed and the buzzer is operated from a 60-cycle supply through a bell-ringing transformer. Considerable difficulty was experienced in obtaining a sufficient amplitude of vibration, but this object was finally accomplished by tuning the vibrating parts.



MECHANICAL OPERATING CHARACTERISTICS OF TYPE H-6 OIL SWITCH

In using the apparatus the indicator is mounted rigidly on the cell structure of the oil switch, and the motion of the switch is communicated to the indicator drum by a cord attached to the top of one of the switch rods and running parallel to the rod over a pulley attached to the cell structure, below the lowest position of the point of attachment of the cord. From the pulley the cord passes directly to the reducing motion, which is adjusted to give a record about 3 in. long when the switch operates.

The armature of the buzzer is attracted to the magnet each time the alternating supply voltage reaches its maximum value, either in the positive or the negative directions and consequently vibrates with a frequency which is twice that of the supply. This was checked by connecting the graphic cycle counter in parallel with an indicating cycle counter and closing the supply circuit momentarily while the indicator cord was pulled by hand. The results of two methods agreed within one cycle—the error of starting or stopping the cycle counter, which depends on the point of the voltage wave at which contact is made or broken.

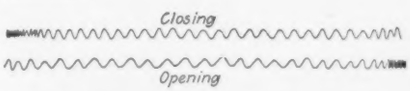
The ratio of reduction of the reducing motion was determined in three ways—(1) by counting the teeth of the reducing gear and scaling the drum and pulley, (2) by

successively drawing out the cord for intervals of 6 in. and closing the supply switch momentarily at each point, the distance between the resultant point of rest on the chart record being scaled, and (3) by measuring the stroke of the oil switch and scaling the corresponding chart record. Methods (2) and (3) are identical, except that in (3) the actual conditions of cord tension, etc., exist. With the conditions under which the operation of the apparatus has been tried—that is, on an H-6 switch, whose stroke is 19½ in.—these methods give results as follows: (1), 6.32; (2), 6.51; (3), 6.39; average, 6.41. The results were calculated using a ratio of 6.4, which agrees closely with the measurements under service conditions.

Results of Trial

A trial of the apparatus was made on an oil switch in the Delaware station. This is a type H-6 oil switch, No. 615,233, rated 500 amp., 15,000 volts. The stroke of this switch is 19½ in. and the main contacts open when the switch rods have moved up 2¾ in.

A sample record showing the opening and closing of this switch follows:



In this case the return motion of the switch was slow enough to allow the springs in the indicator to force the drum to follow the switch. If the motion of any switch should be very rapid, it may be necessary to arrange the cord to pull the drum when closing the switch as well as in opening it.

It will be noted that the double amplitude of pencil motion of about 0.06 in. is very satisfactory, at least for this speed of switch motion. By comparing the distance between successive waves the motion of the switch is seen to start at a moderate rate, to increase to a maximum at about mid-stroke and to decrease gradually until a definite point a little before the end of the stroke the motion suddenly becomes very slow—too slow, in fact, to determine by this method. This slow motion at the end of the stroke is due to the operation of the motor in winding up the operating springs in preparation for the next movement of the switch.

The operation of the apparatus in timing the switch motion was judged quantitatively by opening and closing the switch several times in rapid succession, the tracing point being displaced between each operation to leave each record clear. The distance from the starting point on the record was measured to that point of every wave which was in the phase of the wave at the start of the motion. It is rather difficult to determine this phase with the naked eye in most cases, but if a strong light and a magnifying glass are used, it can be determined to an accuracy of about one-twelfth of a cycle of the pencil frequency—that is, to about one twenty-fourth of a cycle of the 60-cycle supply or about 0.0005 second to 0.0010 second, which is considerably closer than is necessary in most cases.

Each of five operations of the switch in opening was scaled for every cycle to 0.01 in. on the chart, and the results were averaged, the average being carried out to thousandths of an inch. In no case did the difference between the maximum and minimum values for any one cycle differ by more than 0.03 in. Similarly four records made in closing the switch were scaled. The greatest deviation in closing was 0.04 in.

These distances multiplied by the ratio of reduction of 6.4 were plotted as ordinates, the abscissas being time, expressed both in seconds and in terms of the 60-cycle supply. The distance moved in each half cycle divided by the time of one-half cycle (0.00833 second) gives the velocity in inches per second. This was also plotted. An error in scaling the switch position of 0.01 in. on the chart corresponds to an error in velocity of about 7 in. per second. The velocity curve therefore affords a very severe test of the accuracy of the method. These curves are reproduced herewith. It will be seen that in only one case is the error as great as 10 in. per second.

Conclusions

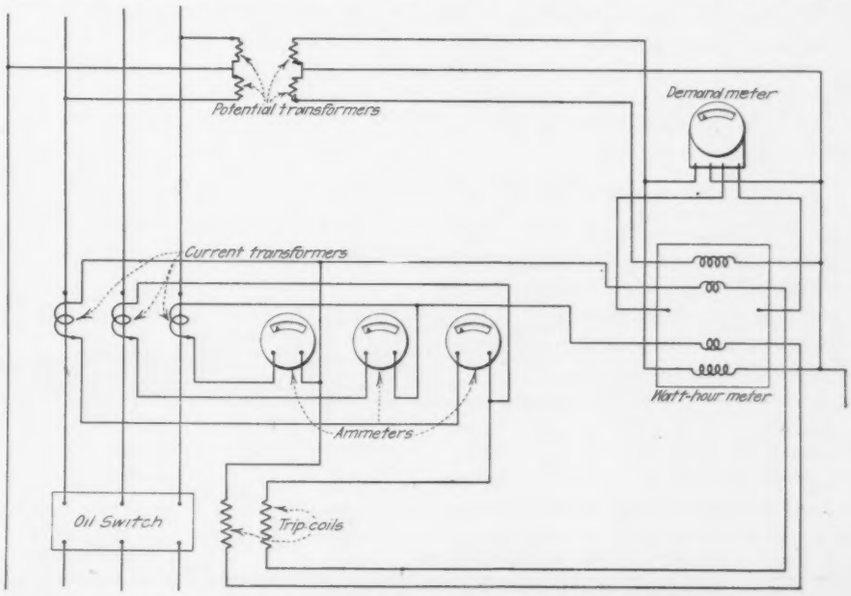
This apparatus is adaptable to almost any type of solenoid or motor-operated oil switch, or, in fact, to almost any large, rapidly moving apparatus having an intermittent, reciprocating motion. It can be attached to any such apparatus with little difficulty and in a short time.

In general, it would not be necessary to work out the distance-time and velocity-time curves as has been done in this article, since a mere inspection of the chart record yields a fairly good idea of the operation of the apparatus.

Temporary Instrument and Meter Connections

By W. F. Walsh
Meter Supervisor Kingston (N. Y.) Gas & Electric Company

THE arrangement shown in the accompanying illustration was used in an emergency to measure the current in each line of a three-phase, four-wire circuit that had just been changed over from three-phase, three-wire. A four-wire meter ordered for this job had not been received, thus making it necessary to resort to the layout shown. The original circuit was three-wire with meters and instruments consisting of a two-current coil polyphase



EMERGENCY METER CONNECTION FOR FOUR-WIRE CIRCUIT

watt-hour meter, a demand meter, three ammeters and a two-trip coil oil switch in the current transformer circuit.

On the changeover the load was light enough to permit a delta current transformer connection on the meter and trip coils without seriously overloading the current coils. The ammeters were to be connected to show the line current and the balance of same. The illustration shows how this was done. Ultimately the oil-switch trip coils will be connected to a separate set of current transformers *Z*-connected.

Computing Tension in Transmission Lines

The Method Described Has Correct Mathematical and Physical Basis and Gives Results that Are Accurate Within 1 per Cent

BY E. S. THAYER
Electrical Engineer, Seattle, Wash.

THE calculation of the tension resulting from a change in loading and temperature of an isolated span fixed to rigid supports at each end is not a difficult matter. When, however, the two fixed points in the cable are separated by several spans of different lengths supported in a frictionless manner, or nearly so, the problem becomes more complicated. The correct average span to use in obtaining the stringing tension for wires on suspension insulators has never been worked out satisfactorily to the writer's knowledge. No handbook or periodical reference concerning this matter could be found. The usual methods are to use (a) the arithmetical average of the actual span lengths or (b) the arithmetical average of the equivalent span lengths. Both of these methods are inaccurate, the error in some cases being as high as 15 per cent. The method described herein has a correct mathematical and physical basis, is easy of application and gives results that are correct within 1 per cent.

A stringing chart (Fig. 1) is usually prepared for transmission-line work and may be used for isolated spans or for sections comprising spans of the same length by simply entering the span length and reading the stringing tension for any temperature desired. For sections of conductor made up on spans of different lengths the difficulty consists in knowing what span length to enter the chart with. The following solution is offered as giving a correct average span length. The difference betwen this average and others now in use is illustrated by an example:

DERIVATION OF AVERAGE SPAN LENGTH

For an isolated span (Fig. 2):

$$C = L + E,$$

in which $E = 8D^2/3L$ (1)

But $D = WL^2/8T$ (2)

From (1) and (2) $E = W^2L^3/24T^2$.

This is the difference between the span length and cable length. If one end is considered fixed and the other movable and the unit loading is reduced from W_o to W, the point P would move to the right a distance

$$E_o - E = (L^3/24T^2)\ (W_o^2 - W^2)$$

plus a temperature expansion when heated t degrees which is atL, bringing P to P'. The resulting tension in an isolated span would be obtained by reducing the tension T_o until P' returned to P, the movement to the left consisting of the elastic contraction $= (T_o - T)\ L/MA$

plus the increased length of curve

$$= (W^2L^2/24)\ (1/T^2 - 1/T_o^2)$$

Equating PP' with $P'P$ and combining will give

$$at + (T - T_o)/MA = (L^2/24L)\ (W^2/T^2 - W_o^2/T_o^2) \quad (3)$$

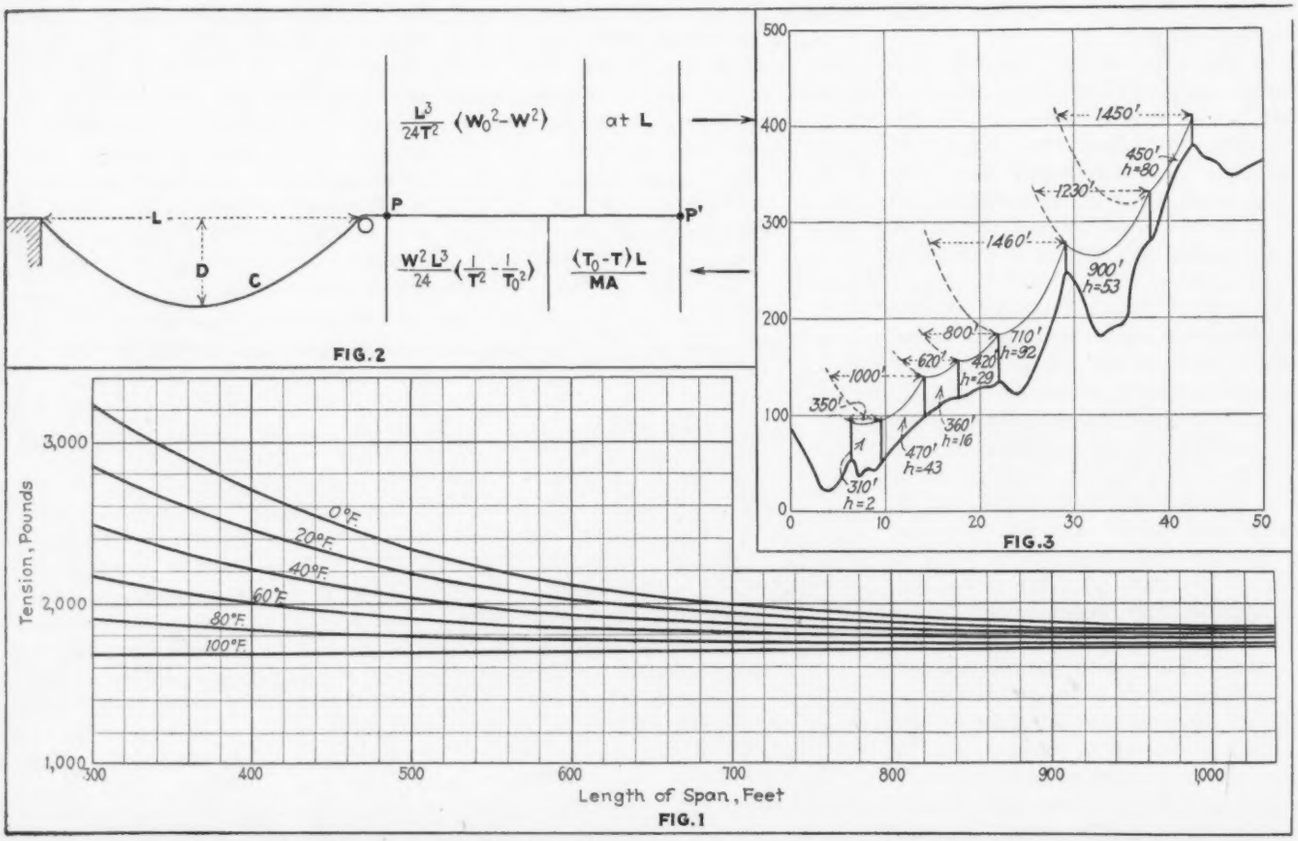


FIG. 1—STRINGING CHART FOR TRANSMISSION-LINE WORK. FIG. 2—ISOLATED SPAN CALCULATIONS. FIG. 3—ACTUAL PROFILE OF LINE HAVING A NORMAL SPAN LENGTH

in which T is the tension resulting from a change in loading and temperature. Similarly, for a section of any number of spans, an equation may be written between the left and right movements at the end of the section (L and L^3 being the only quantities varying from span to span) by substituting in (3) ΣL for L and ΣL^3 for L^3, giving

$$at + (T - T_o)/MA = (\Sigma L^3/24\Sigma L)\ (W^2/T^2 - W_o^2/T_o^2) \quad (4)$$

Solving this for T gives the resulting tension for the section. Comparing (4) with (3), it is seen that this value of T is the same as would be obtained from (3) for an isolated span undergoing the same changes, but having the length

$$L' = \sqrt{\Sigma L^3/\Sigma L},$$

in which L' is the correct average span based on parabolic formulas.

Example.—The following example gives a comparison between conductor tensions obtained with L' and by means of other average spans.

A section of an actual profile laid out is shown in Fig. 3, for the purpose of illustration, with a line having a normal span length of from 300 ft. to 400 ft. except where the topography requires greater tower spacing. The conductor assumed is No. 4/0 stranded hard-drawn copper strung for a maximum tension of 4,300 lb. under class B loading at 0 deg. F. The equivalent spans are drawn as they would exist at 60 deg. F. Calculate L' and other average span lengths as follows:

Number of Span From Left	Horizontal Length of Span (L)	$L^3/1{,}000$	Equivalent Span Length
1	310	29,791	350
2	470	103,823	1,000
3	360	46,656	620
4	420	74,088	800
5	710	357,911	1,460
6	900	729,000	1,230
7	450	91,125	1,450
Totals	3,620	1,432,394	6,910

The various average spans and their respective tensions at zero temperature, taken from Fig. 1, compare as follows:

	Average Span	Per Cent Error in Average Span	Tension	Per Cent Error in Average Span
A*.....	517	17.6	2,300	9.5
B†.....	987	57.2	1,850	11.9
C‡.....	752	19.8	1,950	7.2
D**.....	629	0.24	2,100	0.0

* Average actual span = 3,620/7.
† Average equivalent span = 6,910/7.
‡Mean of average actual and average equivalent spans.
** $L' = \sqrt{1{,}432{,}394/3.620}$

The above calculation of L' introduces a slight error due to the slope of the span supports. It can be shown that this error, expressed in percentage, is very nearly $P^2/400$, in which P is the per cent slope of supports and equals $100h/L$.

In the above example the percentage of error in the computed average span is 0.24 and in most cases is negligible, being only between 2 and 3 for a 30 per cent slope of supports. The calculation of L' is easily made with a table of cubes. It furnishes a correct basis for stringing tension and therefore permits the predetermination of conductor stresses, clearances, and insulator swings with greater accuracy.

SYMBOLS USED IN EQUATIONS

L = horizontal length of span in feet
D = sag in feet
C = length of cable between supports in feet
T = tension in pounds
W = weight of cable in pounds per foot
t = rise of temperature in degrees F.
a = coefficient of expansion per degree F.
M = modulus of elasticity
A = area of cable cross-section in square inches
h = difference in height of supports
P = per cent slope of supports
Subscript 0 denotes maximum design load condition

Power-Factor Metering Equipment

BY C. B. WRIGHT
System Regulation Division, Equipment and Tests Department, Duquesne Light Company

THE city of Pittsburgh presents the Duquesne Light Company with an industrial load that is made up largely of induction and synchronous motors and arc and resistance type furnaces. The question of power factor thus becomes of importance, and although the system power factor has always been reasonably high, an improvement was necessitated in order that the full kilowatt capacity of the generating equipment might be realized. To meet this situation, the 1923 "Schedule of Rates for Electric Service," which became effective on June 22, 1923, contained a power-factor clause whose provisions, in part, are as follows:

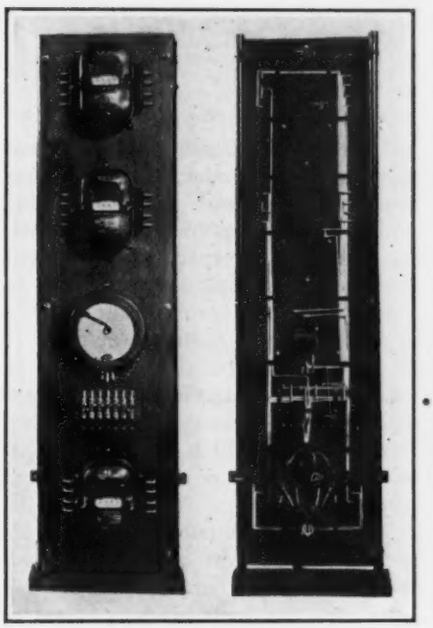
Power Factor.—This rate allows an average lagging power factor of 75 per cent, which corresponds to a ratio of reactive kilovolt-ampere hours to kilowatt-hours of 88.2 per cent (88.2 points). At the option of either customer or company instruments may be installed to measure the consumption of lagging reactive kilovolt-ampere-hours. The gross bill will then be adjusted as follows:

For each reduction of ten points in the ratio of reactive kilovolt-ampere-hours to kilowatt-hours for any month a discount will be allowed on the gross bill computed at the rate of 1 per cent for each such ten points decrease. (Maximum discount, 8.82 per cent.)

For each increase of ten points in this ratio a corresponding charge will be added to the gross bill computed at the rate of 1 per cent for each such ten points increase.

Reactive kilovolt-ampere-hour meters will be ratcheted to record lagging reactive kilovolt-ampere-hours only.

Although both a bonus and a penalty are quoted, the fundamental object of the clause was to secure a higher individual customer's power factor by means of an educational and co-operative campaign against low power factor. The company, through its employes who were handling this branch of the work, desired to educate its customers concerning the evils of low power factor



TYPICAL METER PANEL FOR LARGE INSTALLATIONS

Meters register kilowatt-hours, reactive kilowatt-hours and kilowatt demand. Equipment consists of three 5-amp., 440-volt polyphase watt-hour meters, demand meter, meter testing block, phasing transformer, 440/110-volt transformer and a four-pole transfer switch.

and the advantages of high power factor and to suggest methods by which individual installations might be improved by a rearrangement of equipment or additional machinery. The dollars-and-cents value of the individual improvements to the system as a whole was to be returned to those customers who were affected by the clause.

Since the average power factor and the method of metering it were both specified, it was necessary only to determine the best arrangement of the metering equipment and to install this equipment in order that the clause might be applicable to customer's installations. The company assumed the initiative in regard to the appliaction of the clause, and it was decided to install metering equipment on installations which had a demand of 200 kw. and above before attempting to meter those having lower kilowatt demands. The panel shown herewith was designed

POWER FACTOR OF VARIOUS INDUSTRIAL LOADS IN PITTSBURGH

Type of Load	Voltage	Kilowatt Demand	Power Factor, Per Cent
Arc furnace	20,000	2,800	86.9
Induction and synchronous motors	2,200	1,220	100.0
Induction and synchronous motors	2,200	218	96.5
Arc furnace	10,000	3,400	85.0
Induction and synchronous motors	2,200	832	95.4
Induction and synchronous motors	2,200	356	100.0
Induction and synchronous motors	440	1,344	83.7
Synchronous motors	2,200	219	99.8
Synchronous motors	20,000	900	98.3
Induction motors	220	390	52.2
Induction and synchronous motors	440	176	79.6
Arc furnace, synchronous motors	10,000	1,493	84.4
Arc furnace	220	866	99.7
Arc furnace	20,000	4,600	94.6
Induction and synchronous motors	2,200	216	70.2
Synchronous motors	2,200	3,120	98.0
Induction and synchronous motors	440	272	75.1
Induction and synchronous motors	2,200	850	100.0
Synchronous motors	2,200	1,428	99.3
Arc furnace	20,000	1,034	94.2

by the meter department and was adopted as standard for high-capacity installations. The following equipment is shown: Two kilowatt-hour meters, a ratcheted kilowatt-hour meter, demand meter, testing block, phasing transformer and a four-pole, double-throw switch to facilitate testing the reactive factor meter. The 18-in. by 72-in. ebony-asbestos board panel is bolted to two 1.5-in. pipes which are supported on a short section of 5-in. channel iron.

More than a hundred such installations have been made since the clause became effective, and the results obtained have been quite satisfactory. Twenty customers whose power factors formerly ranged from 60 per cent to 90 per cent have been taken as being representative of the present number of metered customers, and their power factors as determined from the April meter readings are given in the accompanying table:

The power factors listed in the table may seem to be unusually high for the types of load specified, but it must be remembered that they represent the average values. The instantaneous values in some cases fluctuate over a comparatively wide range for short periods and then assume a constant value, while in other cases this fluctuation is constant for the duration of the load.

A question arises as to what should constitute an equitable power factor for billing purposes, and the answer appears to be that the average power factor should be used. Experience has shown that the characteristics of different types of loads make it undesirable to bonus or penalize customers on the basis of power-factor values determined from instantaneous meter readings or even those taken over a three-minute or four-minute time interval. When inherent load characteristics are such as to make the application of corrective equipment impracticable, or when the instantaneous values of power factor are widely fluctuating while the average values are fairly high, the customer should be billed according to the average condition. For instance, the power fatcor of an arc-type furnace fluctuates over a wide range at the beginning of a heat, but after the first half hour it assumes an approximately constant value, usually between 85 per cent and 95 per cent. Rolling mills and similar machines which have high power demands and short-duty cycles do not readily lend themselves to the application of corretcive measures. On the other hand, loads having almost constant power demands and long duty cycles usually present equal values for the average and instantaneous power factor per installation, so that, in general, the average value of the power factor seems to be the most equitable to both consumer and producer.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Street Lighting Switches and Insulating Transformers

INSULATING transformers for series lighting circuits shall be installed as shown in Fig. 71, where these transformers are necessary. Normally oil switches will be installed on the primary side of indoor constant-current transformers. An automatic time switch shall be used on the primary side of each outdoor constant-current transformer. This shall be housed in a wooden box (Fig. 72) mounted, as shown in Figs. 68 and 69 (see ELECTRICAL WORLD for July 5, 1924, page 20.) To this box shall be added two 2-in. x 1-in. x 3-ft. planed strips fastened to the box as shown by 1½-in. wood screws, the box in turn being fastened to the cross-arm by four ⅝-in. galvanized machine bolts. Cut-outs shall be installed between the time switch and the line.

The secondary leads of outdoor constant-current transformers shall be connected to the series circuit through No. 8 flexible leads, equipped with standard clamps as shown in Figs. 68 and 69, so that the circuits may be disconnected for testing purposes.

No cut-outs shall be opened or closed while circuit is alive.

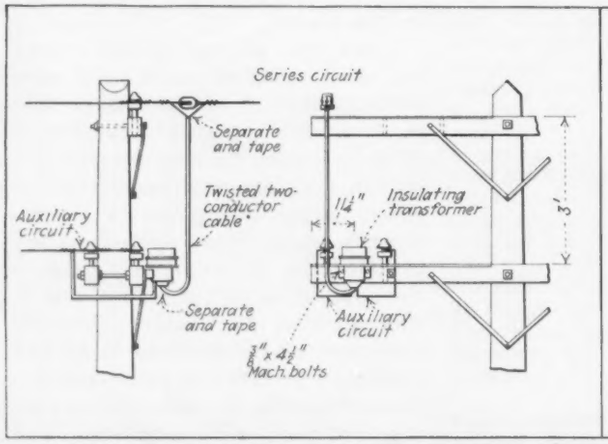


FIG. 71—INSTALLATION OF INSULATING TRANSFORMER

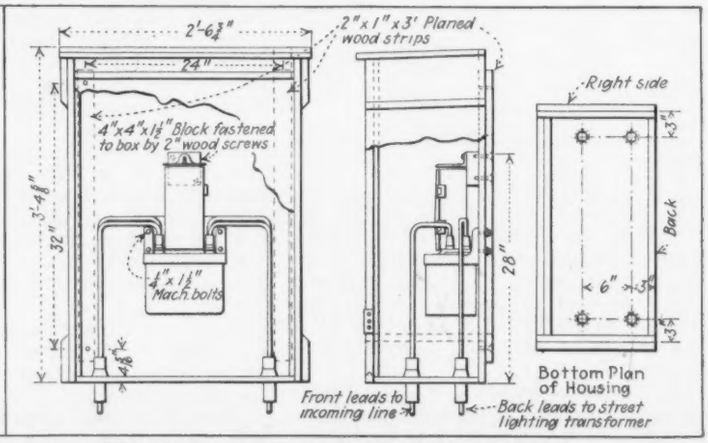


FIG. 72—CONSTRUCTION DETAILS OF BOX FOR TIME SWITCH

Central Station Business

Central Station Conducts Safety Slogan Contest

TO ENCOURAGE its employees and the general public to think in terms of public safety the Georgia Railway & Power Company has started a slogan contest in Atlanta. Each week slogans from employees of the company designed to impress upon employees, pedestrians and automobile drivers the necessity of observing safety precautions, are handed in to a slogan committee of three prominent citizens. These three select the slogan they think the best, and the winner receives $5 for the best slogan of the week.

Each week the winning slogan is printed on the street-car dash signs, car cards and posters, and so far results have been very satisfactory. The five-dollar reward stimulates a keen interest in the contest among the trainmen, and some of the most effective advertising slogans used have resulted from this contest.

The public relations department of the power company is bending every effort to check the number of accidents from careless driving that appear to have swept over Atlanta recently, and these slogans have been found very effective in inducing a "stop, look and listen" attitude on the part of the company's employees.

Central-Station Windows Used for Dealers' Displays

AN ELECTRICAL merchandising business is not carried on directly by the Western New York Electric Company, Jamestown, N. Y., but a plan has been worked out to assist local dealers in obtaining new business by forming a co-operative club of about a dozen of the electrical dealers of the community for the use of the utility company's display window. Inside and to the rear of the display window has been erected a half-height wooden panel, which practically incloses the window from the office inside. On this panel are printed the names of the dealers who make use of the system.

Each dealer may use the display window for a period of ten days at a time, displaying such electrical merchandise or equipment as desired, together with the name and location of the store. Feeling that it was in a position to offer suggestions for improvements, the utility company reserves the right to approve or disapprove of the display.

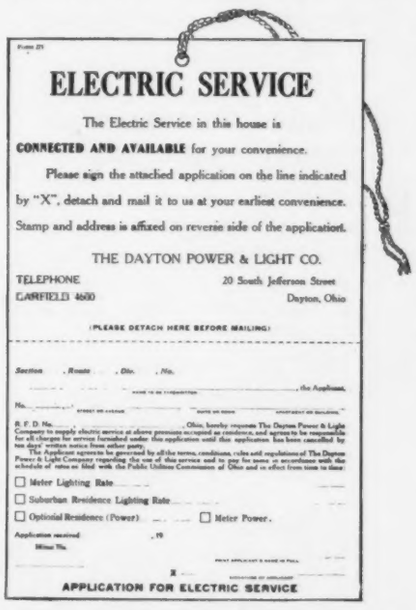
The company, which operates in the city in competition with a municipal system, but serves practically the entire county of Chautauqua, outside the limits of the city, claims that, with no investment except for the show window, it has been able to obtain a good amount of additional revenue. At times when the window is not in use by the dealers the company itself sets up a display, showing the source of its power supply by means of a well-lighted map of the Niagara frontier with the hydro-electric stations at Niagara Falls. Without actually retailing the merchandise itself, the company has been able to arouse the interest of its customers in the face of competition from the city-owned plant.

Handling Connect and Disconnect Orders

Practice of Dayton Company in Leaving Residence Meters Connected Results in Better Service with Insignificant Loss of Energy

BY A. W. ISENHART
Customers' Accounting Department,
Dayton Power & Light Company

IN ANALYZING its residential meter disconnection, reconnection and transfer orders for 1922 and 1923 the Dayton Power & Light Company found that the average elapsed time between a meter "disconnect" and a "reconnect" order was three and four-tenths days. In other words, houses and apartments apparently remained unoccupied for that average length of time. In a great number of instances meters were disconnected in the morning and reconnected again before nightfall. Oftentimes reconnection orders were received too late to be executed by the regular force and resulted in night trouble calls, causing more or less confusion and duplicated effort.


ELECTRIC SERVICE

The Electric Service in this house is

CONNECTED AND AVAILABLE for your convenience.

Please sign the attached application on the line indicated by "X", detach and mail it to us at your earliest convenience.

Stamp and address is affixed on reverse side of the application.

THE DAYTON POWER & LIGHT CO.

TELEPHONE GARFIELD 4600

20 South Jefferson Street
Dayton, Ohio

(PLEASE DETACH HERE BEFORE MAILING)

Section . Route . Dis. . No.

, the Applicant,

No. STREET OR AVENUE NAME OF TOWN APARTMENT OR BUILDING

R. F. D. No. , Ohio, hereby requests The Dayton Power & Light Company to supply electric service at above premises occupied as residence, and agrees to be responsible for all charges for service furnished under this application until this application has been cancelled by ten days' written notice from either party.

The Applicant agrees to be governed by all the terms, conditions, rules and regulations of The Dayton Power & Light Company regarding the use of this service and to pay for same in accordance with the schedule of rates as filed with the Public Utilities Commission of Ohio and in effect from time to time.

☐ Meter Lighting Rate

☐ Suburban Residence Lighting Rate

☐ Optional Residence (Power) ☐ Motor Power.

Application received , 19

Mimeo No.

PRINT APPLICANT'S NAME IN FULL

X SIGNATURE OF APPLICANT

APPLICATION FOR ELECTRIC SERVICE

RED "SERVICE-AVAILABLE" CARD WITH DETACHABLE APPLICATION

With these facts at hand and having a desire to render the public the most complete service possible, it was decided to discontinue the practice of disconnecting meters on residential installations.

Now, when a customer requests a discontinuance of service, owing to the fact that he is vacating his premises, the meter is read and the final bill rendered and collected by the men assigned to this work. Transfer and "discontinue" meter orders are written directly from the customer's ledgers. A red card, known as a "service-available" card, is left in the house in a conspicuous place as an indication that the electric service is available. Then when a new customer moves into the premises all he needs to do in order to establish connection with the company is to sign his name on the application portion of the "service-available" card and drop the card in the mail box—the card having a stamp affixed by the company.

If at the time of the regular monthly meter reading or bill distribution an application has not been received from a new customer at an address where a "service-available" card has been left, the regular meter reader or bill passer tries to obtain an application from the new tenant. If he finds the house still vacant, the service is left on and a check is made again at the next regular call of the meter reader or bill passer, provided that an application has not been received in the meantime.

Meters on commercial installations are disconnected at the customer's request and reconnected on the receipt of application from a new customer, as has always been the custom. The "service-available" card is used for residential installations only.

Customers thus receive two distinct services: The man vacating the premises receives the opportunity of paying his final bill on the premises, and the incoming tenant has the advantage of immediate service without having to call at the company's office to make application.

From March 6, 1924, when this service was inaugurated, to May 31 4,325 orders were executed by the two meter readers, using Ford roadsters, on this work. "Service-available" cards to the number of 2,001 were left by them, 951 of which have been mailed to the company by incoming tenants. Ten complaints were received from customers who questioned the amount of electricity billed to them, resulting in adjustments covering a loss of only 66 kw.-hr.

Some slight energy losses and an occasional complaint were anticipated, but the company is satisfied that the abandonment of primitive methods for this more economical system enables it to render more prompt and uninterrupted service to the public.

"Ads" Show Advantage of High Illumination

COMPETITIVE aspects of modern window lighting have been vigorously displayed in a series of advertisements on this class of service run during the past three months by the Edison Electric Illuminating Company of Boston in connection with the intensive development of this business by the division of illuminating engineering. As indicated in the sample advertisements reproduced herewith, the object of the company is to call the newspaper reader's attention to the less obvious side of poorly lighted windows and the effect of adequate installations upon trade.

Who gets the customers on the dark days?
193% more window shoppers
A window that says "Come in"
A partial eclipse
EDISON LIGHT of BOSTON

HOW LACK OF WINDOW LIGHTING INFLUENCES TRADE

Satisfied Customers as Range Salesmen

FOLLOWING out its plan of selling electric ranges through the agency of satisfied customers, as detailed on page 881 of the ELECTRICAL WORLD for May 3, the Southern Public Utilities Company of Charlotte, N. C., conducted another successful campaign during six weeks in May and June this year. The company, whose general headquarters are in Charlotte, has branches in Winston-Salem, Hickory, Reidsville and Thomasville, N. C., and Greer, Greenville, Anderson and Chester, S. C. It also serves Mount Holly, China Grove, Bessemer City and other small towns in the two states. The company set a quota of 400 ranges as the mark to be reached in this selling campaign. The total number of ranges sold was 424, an excess of twenty-four over the quota.

As a preliminary to the campaign the company sent a service letter to users of electric ranges, asking them if their appliances were giving satisfaction and suggesting that the owners call upon the company at any time they felt the need of help or advice in operating the range. Hundreds of replies were received to this letter, all of them praising the electrical range, and nearly all of the replies declared that the owners would not be without their range for any consideration. Many of these letters were printed in the company's service magazine and were thus brought to the attention of the public generally, as well as to that of a selected list of "prospects" by direct mailing. This selected list of prospects was a big item in the success of the campaign, and its compilation was made possible through the cooperation of satisfied customers of the company who already had ranges in their homes.

The second pre-campaign letter sent out by the company was also sent to electric range owners. This letter asked these housewives to send the company a list of five friends who might be interested in an electric range. Virtually all complied with the request, and the company thus had an exclusive and valuable list of prospects at the beginning of the campaign. Letters were sent to these prospects, and these were followed by calls by the salesmen. Newspaper space was also used freely in calling attention to the merits of cooking electrically.

A prize of $100 was offered by the company to the branch exceeding its quota by the highest percentage. This prize went to Hickory, N. C., which had a quota of forty and sold seventy-four ranges. Greer, S. C., was next. It had a quota of ten and sold thirteen, winning a prize of $50. Prizes of $25 went to every branch that made its quota. There were six of these—Winston-Salem with a quota of eighty and selling ninety-six, Greenville with a quota of sixty and selling sixty-seven, Chester with a quota of thirty and selling thirty-one, Anderson with a quota of forty and selling forty, and Hickory and Greer, which won the special prizes.

The company regards the campaign as one of the most successful it has ever conducted. Not quite so many ranges were sold as in the campaign last year, but more were sold to individuals housewives. While 458 were sold last year dur-

ing the campaign forty-one of them went into apartment houses.

The letters from satisfied customers were an inspiration to the company and sales force. They regard these as their best selling asset. While the campaign was in progress cooking demonstrations were conducted at the different branches. Any doubters thus received a practical demonstration of the utility of the range.

With the addition of the 424 ranges sold this year the Southern Public Utilities Company now has a total of 1,761 connected on its lines. A little less than 10 per cent of the range users also have electric water heaters, and based on an average monthly bill of slightly under $5.50 this class of business accounts for more than $100,000 gross annual revenue for the company.

Service Promptly Restored by Emergency Transformer

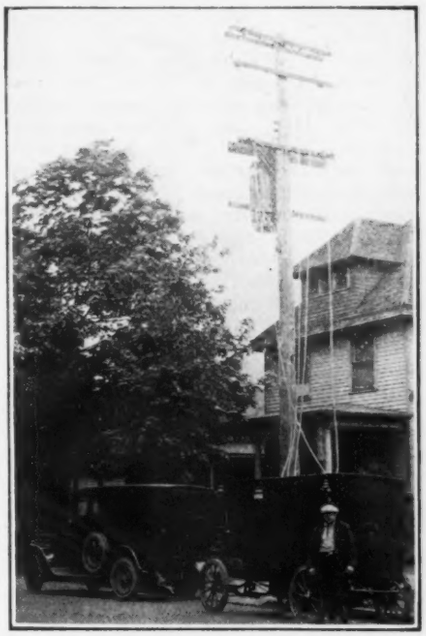
BY H. C. THUERK
Commercial Engineer
Erie Lighting Company, Erie, Pa.

IN FOLLOWING out its policy of constantly improving methods of rendering good service to its customers, the construction department of the Erie Lighting Company has built up a portable transformer and switching equipment mounted on a suitable chassis and inclosed as shown in the accompanying cut.

The equipment consists of a 50-kva., single-phase, standard-distribution type transformer, and oil switch with trip coils in the primary circuit and a double-throw switch in the secondary for adapting its use to either two-wire or three-wire systems. Both the primary and secondary leads are specially insulated for 15,000 volts and are long enough to extend from the truck through telegraph and telephone conductors to the power company's lines. Johnson clamps are used for connections to the primary and secondary distribution circuits. The clamp on the neutral secondary lead is painted red in order to distinguish it from the others.

The use of this equipment makes it possible to restore service in the case of a transformer failure without the necessity of calling out a construction crew. When the service department is notified of a transformer failure, the emergency transformer truck is hauled to the affected area by the service car, and the trouble man promptly cuts the damaged transformer out of service and connects the portable equipment in its place. With this equipment a single man can restore service in quick time. In one particular instance only twenty minutes elapsed from the time the troubleman left the service station until he notified the department by telephone that service had been restored at a point about two miles away.

As has been indicated above, the wiring of the equipment is so arranged that the troubleman can adapt its use to either two-wire or three-wire systems by simply operating a double-throw switch, and in the event that the permanent transformer is damaged through a number of grounds or short circuits such line disturbances, if they are of an ordinary nature, can be removed by throwing the switch to the 110-volt side. In the event that the disturbance has high conductive capacity, no damage will be done or delay experienced through the burning out of fuses on account of the fact that the transformer is equipped with an oil switch with overload protection. Where the disturbance is of high capacity, service can be immediately restored on one-half of the three-wire system while repairs are being made to the line causing the disturbance.



PORTABLE EQUIPMENT WHICH RESTORES SERVICE IN TWENTY MINUTES

The housing for the equipment is so constructed that it can be taken apart easily and quickly for making repairs to the apparatus. By removing a few screws the entire housing can be lifted from the truck.

Brass Industry Heavy Power User

A STRIKING instance of the growing importance of central-station service is afforded by the brass-manufacturing industry of the Naugatuck Valley of Connecticut. Today about 90 per cent of the brass melting in this valley is done in electric furnaces, and to melt 500,000,000 lb. a year about 50,000,000 kw.-hr. is required. There is also considerable evidence of a gradual substitution of electrical energy for wood, coal and oil in annealing furnaces, and this latter use will permit the employment of new equipment and new methods, with resulting increased production and reduced labor content. To anneal in electric furnaces, the production obtained from the amount melted would require 150,000,000 to 200,000,000 kw.-hr. a year.

The American Brass Company, for example, has plants in Waterbury, Torrington, Ansonia, Buffalo, Kenosha, etc., and for some time has shown a preference for purchased power. Nearly all of the power used in Waterbury is purchased. This company is now installing additional production facilities in Ansonia, and the power needed will be purchased from the Derby Gas & Electric Company, which in turn is tied in electrically through 66,000-volt lines with the Connecticut Light & Power Company.

The Scovill Manufacturing Company and the Chase Companies both have modern generating plants, in which additional generating equipment could be installed. About two years ago both companies found themselves in need of additional electrical capacity. The immediate need was for electrical melting, but in the future could be seen a need for more power for electrical annealing. At the same time there was an anticipated development in hydro-electric power which made permanent investment in additional facilities a doubtful procedure. Responding to a request on the part of the Connecticut Light & Power Company, which had advised that it was planning to go ahead with the new Devon steam plant, negotiations were started and carried on independently by each of the two companies. Both negotiations resulted in a decision to purchase the required increase of power, the service to begin approximately with the starting up of Devon.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

New 10,000-Kw. Station Built in Six Months.—For supplying a colliery in England a 10,000-kw. station was recently constructed in which the first 5,000-kw. alternator was operating six months after construction started. At the same time a 9,000-kva., 6,600/33,000-volt outdoor substation was constructed with a transmission line 40 miles long. Construction features of the power plant, transmission line, substations throughout the system and other interesting features are described. — *Electrical Times* (*England*), May 15, 1924.

Tendencies in Surface-Condenser Practice.—Certain definite trends in the design and application of surface condensers are shown in a survey of recent installations and by the plans for plants under construction. A detailed tabulation and various illustrations give the features of some of the representative installations, indicating these tendencies. These tendencies are shown by the use of steam lanes to reduce surface drop through the condenser and to maintain a high hot-well temperature, by graduated tube spacing, elimination of dead tube space by directing the steam flow through all parts of the condenser, multiple air-suction openings, reduction in the ratio of cooling surface to turbine capacity through the use of higher water velocities and heat transfer rates, and the increasing use of steam-jet air pumps.—*Power Plant Engineering*, May 15, 1924.

The Walchensee Plant in Bavaria.—A. BURNER.—Intended for the general light and power supply and all the needs of the electric railways of Bavaria, the Walchensee hydro-electric power station is nearing its completion. It represents one of the largest power centers of Europe. The article under notice deals chiefly with building details and with experiences during the erection of this station. Of particular interest are the descriptions of the very extensive use which was made of the cement-squirting process (Torkret method) for a variety of concrete jobs. The installed generator capacity is 168,000 hp., being divided into two separate sections, one for three-phase light and power, the other single-phase for railroad supply. The former comprises four spiral Francis turbines of 24,000 hp. each, connected directly to 20,000-kw., 500-r.p.m., three-phase generators. The single-phase section has four twin Pelton wheel units of 18,000 hp. each, producing 6,400-volt, 16⅔-cycle, current and running at 250 r.p.m. For its own power requirements two three-phase Pelton units of 450 hp. and 850 hp. are installed in the station. All these waterwheels are fed from six steel penstocks of 7-ft. diameter each, giving a hydraulic head of 655 ft. The lake from which the water is derived has a storage capacity of 110,000,000 cu.m. A yearly output of 160,000,000 kw. is expected. The complete station required about eighteen million working hours for its erection. —*Die Waserkraft*, May, 1924.

Generation, Control, Switching and Protection

Correction Factor of the Air-Gap Induction in Electric Machines. — S. MOCHIZUKI. — The flux distribution along the air gap in electric machines with open slots is investigated experimentally by an electro-dynamical method. This study is made first with slots on one surface only, both with infinite tooth permeability and constant tooth permeability, and, second, with slots on both opposing surfaces and infinite tooth permeability. From the results obtained the writer has established an experimental formula for air-gap-correction factor. He compares this formula with similar ones, proposed by other investigators.—*Journal of Institute of Electrical Engineers of Japan*, February, 1924.

Load-Dispatching System.—Continuity of service and regulation of voltage are both of prime importance in the operation of large electrical systems. With a complicated network fed by several stations it is necessary that a very efficient control system be adopted. The load-dispatching system developed for the Pacific Gas & Electric Company is an admirable example of the control of large amounts of power. The centralized control and the part the telephone system plays in the dispatching scheme are described. — *Power Plant Engineering*, May 15, 1924.

Largest Straight-Reaction Turbine.—E. H. THOMPSON.—A consideration of how the internal conditions in the 62,500-kva. turbo-generator installed in the Brooklyn Edison Company's Hudson Avenue station vary with different loads. This turbine has no impulse velocity wheel and is entirely a reaction type. It is served by the largest service condenser that has as yet been constructed. The conical cylinder bores of this turbine give improved efficiency.—*Power*, June 24, 1924.

Transmission, Substations and Distribution

Cable Testing by Means of the Kenotron.—S. J. TERPSTRA.—A description of the apparatus necessary for cable testing with the kenotron and a report of experience obtained with this method are given. For more than a year this has been the standard method of test on the cable system of Amsterdam, Holland. Instead of the heavy transformers necessary for alternating-current testing on account of the high capacity of cable systems, the kenotron direct-current test calls only for small portable apparatus. Pictures, diagrams and oscillograms are given.—*Sterkstroom*, April 9, 1924.

Pacific Coast Electrical Association.—The entire issue is devoted to the report of the Pacific Coast Electrical Association convention recently held. Of particular interest to engineers are the reports on overhead construction and operation, substitutes for wooden poles, aërial cable construction, line switches, fuses and protective devices, the special sub-committee's report on 4,000-volt overhead distribution, and related subjects.—*Journal of Electricity*, June 1, 1924.

Power Transmission Lines—II—W. T. TAYLOR.—The second of a series of articles on this subject, in which the line voltage and the spacing of the line conductor are determined (not assumed) and a formula is given. In this formula for line voltage the author omits the cost of energy, but takes account of the distance and the kilowatt-ampere capacity. A chart is given for finding the line reactance for any spacing of line conductors met with in practice. — *Electrical Review* (*England*), June 6, 1924.

Units, Measurements and Instruments

Thermal Wattmeter.—H. W. L. BRUCKMAN.—The author describes a wattmeter with thermal elements especially constructed for the measurement of dielectric losses in cables. It can be used to advantage for measuring power at low power factor. By means of a simple attachment one meter can be used for measurement of current, voltage, power or power factor. One element carries the sum of the current and a current proportional to the voltage, another element carries the difference of the same currents. The difference in heat developed by the two elements is proportional to $(I + i)^2 - (I - i)^2$, or $4Ii$. This again is proportional to the power to be measured. The difference in heat developed is measured by bucking two thermocouples.—*Sterkstroom*, April 23, 1924.

A Portable Magnetometer.—J. H. SHAXBY.—The magnetometer of the commutated inductor type is designed primarily for field work, especially in mountainous or otherwise difficult country. It is arranged to measure the vertical intensity and the dip, the first by neutralizing the earth's vertical component by the field due to a horizontal coil supplied with an adjustable current from a small secondary cell, the second by tilting the instrument through an angle until the component field, normal to the base of the instrument in the tilted position, is again neutralized. The dip is then given by the complement of one-half this angle. The two necessary elements are thus measured with a minimum of manipulation.—*Journal of Scientific Instruments*, May, 1924.

Illumination

Co-ordination of Research in Illuminating Engineering and Some Practical Applications.—J. S. DOW.—The author makes a rough classification of different forms of research showing how, while some researches are best under-

taken by manufacturers, others can only be dealt with by an impartial body representing all aspects of illumination. He makes special reference to photometry, statistical data showing the relation between lighting conditions, accidents and production as well as the lighting requirements of various industries. The need for better educational facilities in imparting knowledge of illuminating engineering at technical colleges and the need for additional support in order that the various illuminating societies may extend their work is emphasized.—*Illuminating Engineer (England)*, Vol. XVII, Nos. 1-3.

Capillary Mercury Lamp.—J. H. VINCENT and G. D. BIGGS.—The essential point about the lamp described is that it consists of an open U-tube. Clean, dry mercury is poured into the tube and direct emf. applied by iron electrodes dipping into the mercury in each limb. A portion of the U-tube must be capillary. On vaporizing the mercury in the central part of the capillary tube an arc can be started and maintained in the capillary. Details of the construction and behavior of such a lamp are given. The lamp can be constructed to operate on any direct voltage from 100 upward. It takes very little energy and as far as can be determined there is no limit to its working life.—*Journal of Scientific Instruments*, May, 1924.

Life Tests of Incandescent Lamps.—The Bureau of Standards has conducted life tests on various types of electric lamps. The results so far obtained show that the lamps furnished by all contractors have been of a satisfactory quality, in many cases exceeding the requirements of the specifications.—*Technical News Bulletin No. 86 of the Bureau of Standards.*

Motors and Control

Synchronized Induction Motors.—C. FELDMANN and J. ABERSON.—A theoretical treatise with nineteen diagrams and curves. The authors discuss a motor with rotating field poles and complete three-phase winding in the pole shoes. A resistor is permanently connected across the direct-current field. The motor has five slip rings, three for alternating-current starting and two for the direct-current field. The best moment for closing the field switch is found. A description is also given of the principles involved in the operation of the motor, which consists virtually of a combination of a synchronous motor and a rotary converter. —*Tydschrift voor Electrotechniek*, April and May, 1924.

Researches on the Safe Use of Electricity in Coal Mines.—W. M. THORNTON.—The limiting electrical conditions under which ignition of coaldust and firedamp may occur have been subjected to investigation in the author's laboratory for the past fourteen years as part of a general investigation of the mechanism of ignition of gases. The paper contains an account of some results of practical interest and deals with the electrical ignition of coaldust alone, coaldust with gas present, of methane and associated gases by disruptive sparks, steady or impulsive, transient arcs, direct or alternating, with varied voltage and frequency, in all percentages of mixture with air. Examples are given of the application of the results to promote safety in mines, notably the influence of currents of higher frequency than usual, of safety bells, safety lamps which give an alarm signal when dangerous mixtures of gas occur and a description is given of an improved earthing plate. —*Journal of the Institution of Electrical Engineers*, June, 1924.

Oil-Field Electrification.—C. H. MCCARTHY-JONES.—At Burma, India, an extensive electrification program has been carried out at the Yenangyoung oil fields. Nearly one thousand wells are served by a special power plant built for this purpose. The power station, distribution line, substation and details of the oil-field electrification are dealt with.—*Electrical Times (England)*, May 22, 1924.

Heat Applications and Material Handling

Transportation of Material in Railway Shops.—J. M. THOMAS.—A very comprehensive idea of the delivery system of the shops of the Norfolk & Western Railway at Roanoke, Va., with a description of how materials are delivered to and from the shops and yards, together with the organization and system, schedules maintained and equipment used, is given. The electric tractors and trailers follow a very definite schedule and route which materially aids the shop output. Some gasoline tractors are also used.—*Railway Review*, June 14, 1924.

Electricity Versus Oil for Heating Iron Enameling Furnaces.—H. A. MULVANEY.—The author makes some interesting comparisons on the cost of operation and the results obtained in the use of electrically heated enameling furnaces and of those in which fuel oil furnishes the heat. These furnaces are in operation in the plant of the Pacific Sanitary Manufacturing Company at Richmond, Cal. Single-oven electric furnaces, double-chamber muffle oil furnaces, duplex electric furnaces and the operating characteristics of the duplex furnaces are discussed in detail.—*Journal of Electricity*, June 15, 1924.

Traction

Virginian Railway Electrification.—H. K. SMITH.—An outline is given of the conditions which caused the executives to adopt electric traction for that portion of the railroad extending from Mullens, W. Va., to Roanoke, Va., a distance of 134 route miles. Operating conditions, the design of the electric locomotive, the manner in which the locomotives will be operated, power equipment and the transmission and distribution system are described.—*Railway Age*, June 7, 1924.

Power Distribution System of Chilean State Railways Electrification.—D. C. HERSHBERGER.—Reliability of operation has been the main objective of the designers of the power equipment for the electrification of the Chilean State Railways between the port of Valparaiso and Santiago, a distance of 116 miles. The overhead trolley wire is supplied with direct current at 3,000 volts from five alternating-current substations, each with two 2,000-kw. motor-generators, making alternating-current and direct-current substations an essential link in the power supply system. A special method of integrating power demand is used in connection with bills of the power company supplying the railway.—*Electric Railway Journal*, June 7, 1924.

Telegraphy, Telephony, Radio and Signals

Telephone Transformer and Design of Ideal Circuit.—T. MICHIDA.—Three kinds of transmission losses at the junction point of two circuits having different impedances are explained. The ideal transformer which minimizes these losses is such that its primary and secondary impedances are in conjugation with those of the circuits respectively. The methods of determining the terminal impedances to get an ideal circuit when these are connected to the terminals of any type of circuit, and of designing a transformer which makes the circuit ideal when it is inserted at the junction point of two given circuits of different impedances, are described.—*Journal of the Electrical Engineers of Japan*, February, 1924.

Propagation Phenomena and Disturbances of Reception in Radio Telegraphy.—F. KIEBITZ.—The propagation of electromagnetc waves over the earth's surface is studied, particularly for very long-distance transmission, for which it is deduced that short waves are inherently unsuitable. Methods of quantitatively determining the strength of received signals are shown to be necessary, and some of the results obtained by their use in connection with diurnal and seasonal variations of transmission are given. The simultaneous appearance of disturbances of reception at widely separated points is investigated and found to exist, and it is concluded that the source of such widespread disturbances may be iron-containing portions of the earth's crust subject to varying magnetic fields and with a stepwise altered magnetization according to the Barkhausen effect.—*Proceedings of the Institute of Radio Engineers*, June, 1924.

Development of the Bellini-Tosi System of Direction Finding.—J. A. SLEE. —The paper gives an account of the various sources of error which have been encountered during the development of the Bellini-Tosi system of wireless direction finding as an aid to navigation in the British mercantile marine. These errors can be isolated and their causes removed one by one. The application of the instrument to the purposes of navigation is also dealt with, and the possible errors, external to the ship, which may be encountered are considered. A table is included showing the high degree of accuracy which has now been attained. This direction finder has now been developed so as to be entirely satisfactory.—*Journal of the Institution of Electrical Engineers*, June, 1924.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

Light and Work

By M. Luckiesh. New York: D. Van Nostrand Company. 296 pages, illustrated. $4.

Mr. Luckiesh, in this latest book of his, says: "Too often we hear the so-called 'practical man' speak of laboratory results as having little bearing on practice." Then throughout the text he shows how the laboratories can and do supply the data that encourage progressive men to increase illumination intensities much beyond those that have been used so far. Before going into a description of some of the actual tests and results obtained in the laboratories, a rather exhaustive dissertation is given upon the influences that the sun, skylight, atmosphere, moonlight, starlight and nature's landscape have had on the eye during what the author is inclined to believe was the evolutionary period.

As a result of many ages of association with these influential factors of the great outdoors the eyes became accustomed to fairly high intensities of light. With the oncoming of civilization and man's accompanying migration indoors the eye was confronted with the task of adapting itself to somewhat lower intensities. The effects of outdoor intensities being so indelibly registered in the make-up of the eye, it is quite essential that the intensity used indoors approach that found outdoors if the eye is to function most effectively and efficiently. Such a situation brings up the question as to whether it is more economical to bring the daylight indoors or to make use of a sufficiently high intensity of artificial light.

Attacking this question from the standpoint of even distribution of light, dependability and cost, the author concludes that artificial lighting is not only a formidable competitor of natural lighting from nearly every viewpoint, but in many instances is better and even cheaper than daylight indoors. On this assumption, the subject of artificial illuminants is reviewed and a short history of each given. Valuable information is afforded in regard to each of the different illuminants, their advantages and disadvantages, costs and, last but not least, color relations as compared with natural illuminants. With this basic information as to the relative merits and shortcomings of the different artificial illuminants, the matter of how the eye functions when it is subjected to such light sources next receives attention. The matters of brightness, visual acuity, color sensation, contrast, iridation, adaptation and other fundamentals which play an important part in our visual functioning are then presented from the standpoint both of the visualist and of the lighting specialist.

In conclusion, it is shown how visibility and safety go hand in hand, and many sound reasons are brought forward as to the need of there being a sufficiently high intensity of light if safety is to be promoted. D. J. F.

Storage Batteries

By G. W. Vinal. New York: John Wiley & Sons, Inc. 400 pages, illustrated.

Those interested in the theoretical and practical aspects of storage batteries will be very much pleased with this book, for Dr. Vinal has written as an expert in terms that all will understand and appreciate. The book is a complete treatise on the theory of batteries, on charging methods and equipment, on care of batteries and on the remedy for troubles encountered. Not the least valuable part of the book is the treatment of patent electrolytes and other so-called panaceas for batteries.

The theoretical discussion of battery action is splendid, and much new and valuable material on electrolytes and the effect of impurities is incorporated. The double sulphate theory is given at length, with a definite statement of assumptions made and reasons for assuming it to be correct.

The chapters on dismantling and assembly, operating conditions, testing and battery resistance are clearly written and very complete and are particularly valuable for their adaptability for practical use. Special battery applications are thoroughly treated in separate chapters. The book as a whole will be received as the leader in its field. It answers a long-felt need for a really authoritative and complete treatment of modern storage batteries.

L. W. W. M.

The Choice of Switchgear for Main and Substations

By W. A. Coates. New York: D. Van Nostrand Company. 292 pages, illustrated.

The usual systems of connections, reactances, oil breakers, arresters, voltage regulators, switchboards and high-voltage and low-voltage switching equipment are well treated in this book. A brief treatment of automatic stations, general schemes of protection, excitation systems and auxiliary supply systems completes the work. The book is clearly written and contains sufficient examples, data, curves and theoretical information to give engineers a very thorough grounding in the subjects considered. Both foreign and American equipment and practices are reviewed and typical installations for large and small stations are included. An appendix by T. W. Ross treats admirably of automatic converter stations for railway applications, etc., and in addition the latest developments in automatic hydro-electric stations are reviewed.

The book is by far the best in its field and properly belongs in the library of all colleges and central-station engineers. It fills a need that has been felt and is a valuable addition to technical literature.

Elements of Electrical Design

By Alfred Still. New York: McGraw-Hill Book Company, Inc. 528 pages, illustrated.

All teachers of machine design will welcome this text by Professor Still. He treats of the design principles of the usual types of electrical machines on a fundamental yet quantitative basis. Each chapter develops the general principles of the topic and then deals with their quantitative application in a logical manner. An attractive feature is the good assortment of problems that follow each chapter. Detail formulas for minute design solutions, the detailed mechanical and drafting aspects of design and an absence of design detail may cause commercial designers to amplify the text for practical use, but as a text and reference work on design the book is admirable. Chapters are given on the electric, magnetic and dielectric circuits and on their applications to magnets, commutators and commutating poles and the usual types of direct-current and alternating-current machines. Good features of the book are chapters on losses, ventilation and temperature rise and on general mechanical principles to use in designing electrical machines. It should prove a welcome addition to existing books on design and is a particularly good example of a well-written, well-illustrated text by an experienced teacher.

Book Notes

Elements of Steam and Gas Power Engineering. By A. A. Potter and James P. Calderwood. Second edition. New York: McGraw-Hill Book Company, Inc. 338 pages, illustrated.

This clear and concise elementary textbook on the principles underlying the construction and operation of steam and gas power equipment has been completely revised and brought up to date. Additional problems, improved illustrations and a new chapter on units and definitions have been added. While rather elementary in character, the book outlines quite thoroughly the field it sets out to cover and should be very useful as a textbook in technical schools and colleges.

Popular Research Narratives. By Engineering Foundation. Baltimore: Williams & Wilkins Company. 150 pages.

A compilation of fifty short articles on research, invention and discovery. The contributors have told their story in an interesting manner for general readers.

Book Received

Electrical Measuring Instruments and Supply Meters. By D. J. Bolton. New York: E. P. Dutton & Company. 328 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rullings and News of Electrical Men

Another Honor in Contemplation for O. D. Young

The distinguished honor that came to Owen D. Young, chairman of the board of the General Electric Company, when he was made a member of the international conference on the European situation of which General Dawes was chairman and which gave birth to the Dawes reparation plan, may be followed by a still greater honor if the plans of Premier MacDonald of Great Britain and Premier Herriot of France are carried through. Press dispatches from Paris state that it has been agreed by the two Premiers, in consultation at the French capital, to make every effort to have the United States name an official member of the Reparations Commission to act in all consideration of the Dawes plan, and it is also announced that the all-important supervisory agent of reparations payments will be an American. It is believed, the dispatches say, that the Premiers hope to persuade Mr. Young to fill this position during the first critical year.

Wabash River Station Opens

The first two units of the Wabash River superpower station of the Indiana Electric Corporation, a division of the Central Indiana Power Company, went into service July 4 and have begun delivering industrial power to Indianapolis and many other central Indiana cities and towns. These units will generate 40,000 kw. and will be followed soon by another unit of like size and later by others until the full station capacity of 100,000 kw. is reached. The plant, which is built in the center of coal fields, will eventually cost $12,000,000.

Raising of Funds for Hetch Hetchy Not an Easy Task

In a special report sent to the Board of Supervisors of San Francisco, the board of governors of the Civic League of Improvement Clubs and Associations of that city stated that it was the opinion of the latter that separate proposals should be made to the public in regard to obtaining additional funds for the completion of the Hetch Hetchy water system and for the erection of an electrical distributing system in San Francisco. The report said it had been estimated that $33,000,000 will be needed to complete the water project and that in addition to this it will be necessary to spend at least $15,000,000 for the purchase of an established distribution plant from a local power corporation or the municipal construction of a system. Separate bond issues may be submitted to the voters.

City Engineer O'Shaughnessy's valuation of the Great Western Power Company's distribution system at $9,000,000 and of the Pacific Gas & Electric Company's at $23,000,000 and his estimate of $45,000,000 for a new city-owned distribution plant are assailed as excessive by spokesmen for municipal ownership, who denounce him for alleged subservience to the power companies.

San Francisco Will Sell Water to Modesto-Turlock District

The city of San Francisco will sell 100,000 acre-feet of water to the Modesto-Turlock irrigation district at $1.50 per acre-foot for the purpose of supplying the district's irrigation and power needs during the water shortage. This amount represents about one-half the supply now stored behind O'Shaughnessy Dam in the Hetch Hetchy reservoir. M. M. O'Shaughnessy, City Engineer of San Francisco, estimates that the remaining water impounded in the Hetch Hetchy reservoir will be sufficient to operate the 100,000-hp. Moccasin Creek plant when it is commissioned early in 1925. Only enough water remains in the Don Pedro reservoir to carry the irrigation districts through July, and there was danger of an acute water and power famine unless water was obtained from San Francisco.

Bone Bill Likely to Go to Voters in Washington

The first step in getting initiative measure No. 521—a proposed bill in the interests of municipal electric plants—before the voters has without doubt been accomplished in the State of Washington. More than sixty thousand signatures have been filed with the Secretary of State petitioning that the bill in question, known as the Bone bill, be submitted for approval or rejection at the next election. Only forty thousand signatures are necessary to have the measure placed on the ballot, and approximately that number of signatures was received in Tacoma and Seattle alone. In Spokane, however, fewer than one thousand signatures were received. While the power companies still hope to get enough signers to withdraw their names before the Secretary of State has verified the list and counted the number of names submitted, it is doubtful if they can prevent the measure appearing on the ballot next November.

The Bone bill, if carried, will permit cities and towns to purchase, sell and dispose of electricity inside or outside their corporate limits without the payment of any tax thereon. It also will authorize the acquisition, construction, operation and maintenance of facilities in connection with such municipal enterprises and will permit cities and towns to condemn private property, including railroads not common carriers, booming, rafting and sorting works, for such purposes. The power companies are quite sanguine that the measure cannot carry at the polls and are conducting a campaign of education with a view to enlightening the voters on the pernicious effects of such legislation and thus making its enactment impossible.

Southern Power Company's New Catawba Plant

Another step in the water-power development of the Southern Power Company has been assured by official announcement of plans for the immediate reconstruction of the old Catawba hydro-electric plant, 20 miles south of Charlotte. The new plant will have a generating capacity of 80,000 hp. and be of the same size as the Mountain Island plant, 12 miles north of Charlotte, which was completed seven months ago, and almost twice the size of the Rhodhiss plant, development of which was started a few months ago.

The Catawba plant at present has a head of 25 ft. and a generating capacity of 10,000 hp. The old dam will form a part of the new one, which will give an effective head of 65 ft. The new power plant will have four generating units of 20,000 hp. each. The old plant will be kept in operation until the new one is ready to be put into commission, when the former, now obsolete, will be junked. The new Catawba plant will be built by the Wateree Power Company, a subsidiary of the Southern Power Company, with its own organization. Contracts for the purchase of machinery will be let very soon.

The announcement of the immediate beginning of work upon a new power plant will be taken by the public generally as a further evidence of the intention of the Southern Power Company to keep its implied promise when the recent rate increase was given that it would attempt as speedily as possible to develop power for the rapidly increasing demands of industrial North and South Carolina. Of this good faith the letting of contracts for the 45,000-hp. hydro-electric plant at Rhodhiss and the 40,000-hp. steam plant at Duncan, S. C., immediately after the rate decision was handed down, was the first evidence.

Benjamin G. Lamme Dies

Chief Engineer of Westinghouse Had Long Been Ill—Was for More than Twenty Years the Ranking Member of Technical Staff at East Pittsburgh

NEWS came on Tuesday morning, July 8, of the death at East Liberty, Pa., at 8 a.m. on that day, of Benjamin G. Lamme, for twenty-one years chief engineer of the Westinghouse Electric & Manufacturing Company. Mr. Lamme had been ill for several months, and about a week ago his illness assumed a virulent aspect which soon left small hope of his recovery. His death at the comparatively early age of sixty is perhaps attributable to the too heavy and prolonged work which men of his temperament and will power are so prone to insist on performing. The American electrical industry, which lost Steinmetz only last fall and Wheeler, Crocker and other eminent engineers within the last few years, received with universal regret the news of the passing of the man whom many regarded as at the head of his profession, and the feeling that his place could not easily be filled received widespread expression.

His Technical Career

Mr. Lamme was born on a farm in Clark County, near Springfield, Ohio, on January 12, 1864. He was educated in the public schools and at the Ohio State University, receiving the degree of mechanical engineer from the latter institution in 1888. As a student here he developed the extraordinary mathematical ability which was a factor in his future success, and only a year ago he was cited by his alma mater as the "greatest living mathematician"—an honor unique among universities and one which previously had been bestowed only twice, upon Edison and Steinmetz. Of him as of other famous electrical inventors it is told by fellow-workers that he was accustomed to perform intricate calculations connected with the design of machinery mentally, without recourse to pencil and paper.

No real electrical engineering courses existed in the college years of young Lamme, but he became interested in the subject when it was in its infancy, and in 1889 he entered the employ of the Westinghouse company, where he became closely associated with George Westinghouse until the death of the latter.

Young Lamme's practical genius was soon discovered by the late Albert Schmid in the Westinghouse test room, where the former began work. Although methods for calculating the performance of electric motors and generators were then unknown, Mr. Lamme devised a means whereby the saturation curves of existing machines could be checked from test data. In January, 1890, just eight months after entering upon electrical work, he prepared specifications from calculations for a double-reduction railway motor which was built and placed on the market as a commercial machine. Then, from his calculations in the fall of 1890, came the four-pole, single-reduction-gear railway motor with slotted armature, machine-wound coils and a wave of two-circuit winding—the design still standard in railway work.

Mr. Lamme was a prolific inventor, 150 patents standing to his credit. He was largely instrumental in the perfection of many alternating-current devices. Numbered among his early achievements were the design of lighting and generating equipment for the World's Fair in Chicago, in 1893, and the design of the famous 5,000-hp. "umbrella-type" generators for use when Niagara Falls was first harnessed for water power. He also designed the generating and motor equipment for the first big railway electrification, that of the New York, New Haven & Hartford Railroad, following this by electrification work on the Paoli section of the Pennsylvania Railroad and on the Norfolk & Western Railroad.

BENJAMIN G. LAMME

The Synchronous Motor

About the year 1895 Mr. Lamme conceived the idea that led to the development of the well-known type C induction motor with the squirrel-cage rotor. His paper on induction motors, written about that time, is a recognized classic and has been included in Naval Academy textbooks. His work on the synchronous converter, however, he regarded as one of his greatest achievements. For years he fought the battle for it almost single-handed. He won out, and this is now the accepted machinery for converting alternating into direct current.

Then came his conception of the single-phase alternating-current railway system. He had long held the belief that the success of heavy electric railroading lay in the use of a high-voltage alternating current on a single overhead trolley. The main difficulty lay in finding suitable ways and means for utilizing the single-phase alternating current. After several attempts, Mr. Lamme succeeded in designing a series commutator type of motor with suitable characteristics, which he described along with the system of power distribution in a famous paper before the American Institute of Electrical Engineers.

Mr. Lamme was made assistant chief engineer of the Westinghouse company in 1900 and chief engineer in 1903. One of his most recent tasks was the design of the 62,500-kva. Westinghouse generator which this year went into operation at the Hudson Avenue station of the Brooklyn Edison Company. He was not a prolific writer, but had the happy faculty of being able to put his thoughts on paper so that any one with the rudiments of the subject could understand them. One of his greatest assets was his ability to get a physical conception of every problem, and he aimed to give that in his papers. He seldom wrote mathematical papers, not, of course, for lack of ability, but because he regarded mathematics as his tool that was to be put away when the work was done. He was chairman of the board of editors of the *Electric Journal*, the engineering periodical of the Westinghouse company. Another board of which he was chairman was one which passes on the value of new inventions and applications.

Mr. Lamme was a fellow of the American Institute of Electrical Engineers and a member of the Engineers' Club of New York. From the Institute he received the honor of being elected one of the two members from that body on the Naval Consulting Board during the war, and he was also made chairman of the inventions committee on that board. In 1919 he received the Edison medal from the Institute for his engineering achievements. Last year the board of trustees of Ohio State University awarded him the Joseph Sullivant medal in recognition of the value of his work to the world. He manifested a warm interest in standardization.

Personal Traits

Mr. Lamme never married, but lived at East Liberty with two sisters, one of whom was herself for many years the chief designer of direct-current motors for the Westinghouse company. His hobbies included amateur photography, in which he was an adept, and the acquisition of a library which contained, besides a formidable array of technical volumes, a large collection of detective stories and other imaginative literature, particularly that of a weird or fantastic kind.

An outstanding trait in Mr. Lamme's character was his interest in young engineering students. For years he made a study of the young technical graduates who entered the Westinghouse Electric organization, analyzing their abilities and characteristics to adapt them to the work to which they were best fitted. He maintained a design school for these men, in which he gave actual instructions, so that today the methods and knowledge of this great engineer have been passed on to the vast Westinghouse engineering

body and will stand as an inheritance to these engineers in years to come.

His tastes were simple and his modesty extreme. He had no flair for publicity and his name was not familiar to the man in the street, but his impress in the plastic industry with whose phenomenal growth his mature life was coeval was deep and will be lasting.

Tributes to Mr. Lamme

Among tributes paid to the character and achievements of Mr. Lamme as the news of his death spread were the following:

From THOMAS A. EDISON: "I am very sorry indeed to learn of Mr. Lamme's death. He was a man I greatly admired and respected for his ability, capacity and modesty. He made a number of inventions that have been of much importance to electrical science and art, and I regret that his great service has come to an end."

From General GUY E. TRIPP, chairman of the board Westinghouse Electric & Manufacturing Company: "Mr. Lamme was one of the foremost electrical scientists of the world. His many contributions have found world-wide recognition, and his research and development work has made its impress upon the application of electricity to industry in every country in the world. His pioneer work in connection with polyphase generators, synchronous converters and induction motors, which were first exhibited at the World's Fair in 1893, was practically a revolutionary development; in fact, he for years fought the battle for the synchronous converter almost single-handed. It may be fairly said that the single-phase alternating-current railway system was Mr. Lamme's conception, and the publication of his famous discussion before the American Institute of Electrical Engineers upon this subject created much excitement in scientific circles throughout the world. Today a number of influential countries in Europe and some of the largest railroads in this country have adopted the alternating-current railway system as standard. His death marks a distinct loss to the electrical world."

From E. W. RICE, JR., honorary chairman of the board of directors of the General Electric Company: "In the passing of Benjamin G. Lamme the electrical industry loses an unusually able engineer. He originated many successful designs and contributed technical papers which rank high in the records of the electrical society in which he was active."

The ELECTRICAL WORLD asked B. A. BEHREND of Boston, who made the address in appreciation of Mr. Lamme when in 1919 the latter received the Edison medal, to add to these tributes. Mr. Behrend said: "Benjamin G. Lamme's work is contemporaneous with the growth of the Westinghouse company. Interested in mechanics even in early life while living on a farm in Ohio, he became a brilliant student at Ohio University. His first and only connection was with the Westinghouse company at East Pittsburgh, where he progressed from a job in the testing department to the position of chief engineer. He developed the single-reduction street-railway motor, the rotary converter and the type C induction motor. He contributed greatly to the understanding of the theory of commutation. The first 5,000-hp. generators for Niagara Falls were designed by him thirty years ago. The single-phase railway system was peculiarly his creation, and the New York, New Haven & Hartford Railroad is a monument to his courage and enterprise. His original designs for turbo-generators, if they did not survive, were important in themselves. In later years he devoted much time to the training of young men, which he enjoyed greatly. I had known Mr. Lamme thirty years and enjoyed his friendship for a moiety of that period. Reverently and affectionately I pay him this tribute."

From HARRIS J. RYAN of Stanford University, president of the A. I. E. E., the ELECTRICAL WORLD has received the following: "Through the untimely death of Benjamin Garver Lamme, the American Institute of Electrical Engineers and the world of industry, progress and human helpfulness have suffered a loss too great to express in full measure. His life and work will ever stand as a glorious example of the education and working spirit of the modern engineer. He was among the earliest to arrive within the wave of electrical engineers who are now remaking our civilization. He was endowed with an extraordinary supply of well-directed optimism, resourcefulness and good judgment. To him difficulties and limitations were but signals for the next lines of advance. In electrical machinery he accomplished the effective co-ordination of theory and practice in commutation, choice of speeds, frequencies and a host of related factors. He defined the need and found expediency for the development of the direct-current, single-gear reduction and the single-phase, alternating-current railway motors and the 60-cycle synchronous converter. Mr. Lamme maintained a lifelong interest in the education and training of the engineer. In a classical paper presented to the A. I. E. E. on the technical training of engineers he made a powerful presentation of the results of his observations with directness and simplicity."

From ROBERT B. WILLIAMSON of the Allis-Chalmers Manufacturing Company comes this tribute: "The electrical engineering profession and the electrical industry as a whole have suffered an exceptionally great loss by the untimely death of Mr. Lamme, whose work, extending over a period of thirty-five years or more, has been of inestimable value. He was one of the pioneers in electrical engineering, and his inventions and improvements in electrical machinery form the basis of much of our progress in the use of electric power. Aside from his great ability as an engineer, Mr. Lamme was as a man singularly attractive and likable. He was always ready to help others and took a special interest in the education and training of young engineers. As a writer on technical subjects he was unequaled for the clearness of his style, and his large contributions to electrical literature are specially noteworthy for this quality, besides their great engineering value."

From DAVID SARNOFF, vice-president of the Radio Corporation of America: "The death of Mr. Lamme is a great loss not only to the engineering profession to which he made such a distinctive contribution, but to the electrical industry of the United States. He was one of the silent leaders of the engineering industry, whose genius is expressed in creative effort, whose vision covers a range beyond immediate problems and whose work is a monument to their memory. Mr. Lamme typified during his life not only the spirit of research and experiment, but the spirit of practical achievement."

Progress in Tennessee

Hale's Bar Plant Will, It Is Said, Be the Largest Single Power House in the South

WHEN a second 30,000-hp. turbine now being built at the General Electric Company's works is added to the similar unit just ready for service at the Hale's Bar station of the Tennessee Electric Power Company, the steam and hydro-electric plants at that point will, the company claims, constitute the largest single power development now operating in the South—120,000 hp. October 1, the period of lowest water, is set as the date for the operation of this second unit.

The next largest project under way at the present time is the 22,200-hp. development at Rock Island. The present dam is being raised 35 ft. and a second tunnel is being drilled through the mountainside to furnish water for a new power unit. Work on the hydraulic section of this plant is proceeding rapidly, and excavation is well under way for the addition to the present power house to house the new 22,200-hp. wheel which will be ready for use November 1. After the completion of the dam on May 1, 1925, and the consequent increase in head the power house will have a generating capacity in excess of 35,000 hp.

NEW TRANSMISSION LINES

Construction work on the new 66,000-volt transmission line to serve the coal-mining industry in the vicinity of Coal Creek and Careyville is nearing completion. Work will shortly commence on the 66,000-volt substation at Coal Creek, where the current will be stepped down to 11,000 volts for general distribution to industries in that section. In connection with this extension a new outdoor high-tension station has been built at Arlington, on the outskirts of Knoxville.

A new 120,000-volt outdoor substation is nearing completion at Lenoir City. At the Parksville power house the entire switching equipment is being rebuilt. Right-of-way is being cleared and work has commenced on the Georgia tie line which will be built from Ridgedale substation to Rossville, Ga. The line is designed for 110,000-volt operation for interconnection with the line now being built through north Georgia by the Georgia Railway & Power Company. A 110,000-volt outdoor substation is under construction at Ridgedale and the necessary transformers have already been received.

A 44,000-volt substation will shortly

be erected in north Chattanooga near Valdeau, and the present line from Carter Street across the river will be changed over to 44,000 volts. This is the first step in the building of a 44,000-volt power loop around Chattanooga between the Ridgedale and Carter Street stations to safeguard continuous power service in this district.

Human Factor Main Topic at Cedar Point

Ohio Electric Light Association Considers Complete Identification with Geographic Division of N. E. L. A.—Women's Representatives Make Forceful Address

CONCLUDING the succession of spring and early summer electrical conventions, the Ohio Electric Light Association and the East Central Geographic Division, National Electric Light Association, met in joint convention at Cedar Point, Ohio, on Tuesday to Friday of this week. As in so many other conventions, the question of what makes public opinion and how to deal with the human factor in relations with customers and employees occupied a major portion of the convention's deliberations. The mutual nature of the problems of all large business enterprises and the need of repealing certain obsolescent legislation were also discussed. Apparently of local interest only, but having its significance so far as the rest of the country is concerned, was the consideration of avoiding duplication of effort by consolidation of the Ohio association and the geographic divison of the N. E. L. A. Technical subjects dealing with meters, station operation, transmission and distribution and commercial practices were under review in at least three full sessions. These discussions will be reported in a later issue.

RELATIONS WITH N. E. L. A.

Frank Espy, president of the Ohio association, referred in his presidential address particularly to the successful results attending the affiliation of his association and the geographic division of the N. E. L. A., to the value of even closer if not unified relations, and to the necessity of repealing legislation requiring insulated wire in cities and direct current in mines and of taxing utilities on a basis comparable with other industries. Secretary D. L. Gaskill said that if consolidation were favored the maintenance of the *Bulletin* and of the standing committee activities should be seriously considered.

The importance of the human factor in any undertaking was emphasized by Paul C. Martin, president of the Springfield Railway Company, who declared that it is a big mistake in education to treat only of tangibles to the exclusion of human relations. Mr. Martin delivered an earnest address on present unrest and pleaded for education and mutual tolerance.

An explanation of Ohio employers' control of workmen's compensation rates was made by E. I. Evans, actuary of the Industrial Commission of Ohio, who pointed out that the present average premium for utilities is $2.70 per $100 of payroll. General discussion of this subject centered around the liability of employers for men hired outside the state, the extra premium assessment for serious accidents due to negligence, dissemination of experience and co-operation of the association with the commission.

The address on public relations by Martin J. Insull was the outstanding feature of Wednesday morning's session. The electric business, he pointed out, is mysterious to the layman and public education must be a continuous, permanent process. The best medium is the schools. Referring to monopoly in the public utility business as the chief cause of antagonism, the speaker pointed out that utilities must be especially careful to explain the necessity of monopoly, show the difference between commodity business and utility service and eliminate practices that are irritating. Executives can't do these things alone. They must have the help of their organizations.

A demonstration of what the national home-lighting campaign will do to get the general public thinking of better lighting and the effect in increased use of electrical equipment and energy and the reduction in eye strain was made by J. E. North of Cleveland. Frank E. Watts pointed to the great possibilities of educating the public through the school children.

The value of a meter department to central stations was expounded by W. F. Howe, who touched on its relation to gross income and public opinion. Metermen can help in the formulation of rate structures, he pointed out, because they know what can be measured. They can also be helpful in establishing better public opinion and stimulating sales.

UTILITIES AND COAL ASSOCIATIONS

The principal theme of the address by Walter Cunningham, Huntington, W. Va., on Wednesday afternoon was the necessity of public utilities and coal associations standing together in fighting destructive legislation and fostering constructive legislation.

Two excellent addresses were given on the work of women in public relations by Mrs. F. A. Tate, East Central Division chairman, and Helen E. Steiner, Ohio association chairman. Mrs. Tate pointed out that women employees of utilities are usually the first to have contact with the public and that to gain the good opinion of the women is to influence all public opinion. Already, Mrs. Tate said, more than 70 per cent of the thirty-five hundred women employed in the utility industry are organized for this work. Miss Steiner, with a fine command of language and forceful delivery, convincingly demonstrated that with proper selection and training women can supply a means of public contact that will have greater influence than was ever dreamed of. They are, she said, inherently adapted to handle all sorts of personal questions under all conditions.

"Public Opinion and Rate Making" was the subject of an able address by Prof. C. O. Ruggles of Ohio State University. He opened by declaring that the industry will either have to work out its salvation in co-operation with commissions or accept government ownership. After tracing the various stages through which the utility industry has passed and referring to changed economic conditions due to the expansion of the industry and demand for service on the farms, he made the suggestion that serious thought be given to some way of capitalizing on the inherent advantages of service at cost without including its obvious disadvantages. Static rates are impossible with a dynamic industry, he declared. Rates must be adjustable and service at cost plus offers a solution. In addition, he recommended the education of rising generations through the colleges in the economic, political and social problems of utilities, pointing to the work which has already been started at Harvard and to conferences planned at Ohio State University.

Forty-six Manufacturers Will Aid Lighting Campaign

The Lighting Educational Committee of the electrical industry has announced the first list of names to be made public of manufacturers who have pledged financial support to the "better home-lighting" campaign. The chairman of the finance committee, W. E. Robertson, announces that from now on the names of subscribers to the campaign will be published, that the industry may know the progress that is being made in financing this nation-wide movement. The following have susbcribed for definite amounts:

Beardslee Chandelier Manufacturing Company, Chicago.
J. G. Braun, Chicago.
Cox, Nostrand & Gunnison, Brooklyn, N. Y.
Curtis Lighting, Inc., Chicago.
I. P. Frink, New York.
Gillinder Brothers, New York.
Gleason Tiebout Glass Company, New York.
Gillinder & Sons, Philadelphia.
Gross Chandelier Company, St. Louis.
Edwin F. Guth Company, St. Louis.
Hocking Glass Company, Lancaster, Ohio.
Horn & Brannen Manufacturing Company, Philadelphia.
Ivanhoe-Regent Division of the Miller Company, Cleveland.
Jeannette Shade & Novelty Company, Jeannette, Pa.
Macbeth-Evans Glass Company, New York.
Mazzolini Artcraft Company, Cleveland.
Murlin Manufacturing Company, Philadelphia.
Moe-Bridges Company, Milwaukee.
Miller Company, Meriden, Conn.
H. Northwood Company, Wheeling, W. Va.
National Metal Spinning & Stamping Company, New York.
Phoenix Glass Company, Pittsburgh.
L. Plaut & Company, New York.
Alfred Vester Sons, Inc., Providence.

These names embrace manufacturers of lighting fixtures and lighting glassware who came into the campaign during the recent annual meeting of the National Council of Lighting Fixture Manufacturers. Twenty-two other firms of this group pledged their support but have not yet announced the amounts of their subscriptions.

Promoting Rural Service in Tennessee

One of the most ambitious programs for electrification of farms ever attempted in the South has just been announced by E. O. Wessell of Bowling Green, Ky., assistant to the president of the Kentucky-Tennessee Light & Power Company, which, as already announced in these columns, has purchased a number of municipal plants in Tennessee. With the acquisition of these plants an area extending over four counties has been added to the company's territory with a population of more than 100,000, and the company's engineers have found that the towns are so closely grouped as to make it possible to carry voltages as low as 2,300 on its transmission lines, thus effecting a great economy as compared with high-voltage transmission. With the completion of these low-voltage lines power will be available for all kinds of farm service.

The towns to be served are Martin, Dresden, Gleason, Sharon, Greenfield, Dyer, Rutherford, Trimble, Bradford and Obion, which, however, contain only 20 per cent of the company's potential customers. To obtain service the farmers will be asked to combine in groups. If the first group of ten lives along the first mile out of town, they will be asked to pay $60 each toward the cost of the 2,300-volt line and each farmer would furnish his own transformer at a cost of $40, or farmers living close together could divide the cost of the transformer. Officials of the company declare that the density of farm population in the area to be served will place the cost of the service within the reach of all farmers at rates virtually the same as in the cities served, with probably only a slightly higher minimum charge because of excessive line loss.

Wisconsin's Experimental Farm Service

Work has been begun by the Wisconsin Committee on the Application of Electricity to Agriculture, of which Dean H. L. Russell of the College of Agriculture is chairman. The experimental community selected is situated southwest of Ripon, starting near the city limits and extending out about six miles. About fifteen general farmers and two pea viners will have their farms electrified and studied. Accurate records on the use of all electrical equipment and specially made farm machinery will be kept and the results will be broadcasted throughout the state. It is believed the community will be visited by many thousands of farmers during the course of the experiments, which will be continued for more than a year.

The high-voltage power line which will serve the farm electric laboratory is about completed, and within a very short time the farmhouses and barns will be wired for service.

"We believe we are fortunate in the location," said Prof. F. W. Duffe, who is in charge of the investigation, "and that it will prove a very satisfactory community for the work. The area represents good farming conditions. Dairying predominates, although hog raising receives more attention than in most sections of the state. None of the farmers have central-station electric service; most of them have no electric service whatever.

"The farms vary in size from 75 to 240 acres and all are operated by substantial farmers. There are no show places or rich men's hobbies on the experimental line. Every farm is a business proposition and serves to support the operator, who is usually also the owner. All the farmers are eager to have the investigation begin. Two of them have electric lights from individual plants and several have carbide plants, and these farmers are the keenest seekers for the better service."

Huge Saguenay River Plants

Good Progress on Hydro-Electric Development at the Grand Discharge on Lake St. John, Quebec—Duke-Price Plans Are for Ultimate Output of Nearly 1,000,000 Hp.

AMONG the many hydro-electric plants in existence and projected in the Province of Quebec the one now under way at the Grand Discharge of Lake St. John, on the Saguenay River, 30 miles west of Chicoutimi, will rank with the greatest. Work has been proceeding on the development for more than a year and is now well advanced.

The Quebec Development Company, of which J. B. Duke is president and in which Price Brothers & Company, the Canadian paper manufacturers, own a quarter interest, is behind this project. It owns the water-power rights on that stretch of the Saguenay River between Lake St. John and Kenogami, a distance of about 25 miles, with a drop of 300 ft., and in this area two power developments are planned. The upper one, on the Grand Discharge, is at Ile Malignes, 6 miles below the outlet of Lake St. John, and will give a head of 100 ft. It is here that work is now under way on a preliminary development of about 225,000 hp. The scene of the intended lower development is a few miles above the mouth of the Shipshaw River, which runs into the Saguenay and will give a head of 200 ft.

LAKE A NATURAL RESERVOIR

The discharge of the flow from Lake St. John, which has a drainage area of about 30,000 square miles, will be regulated to a minimum of 22,000 second-feet by a dam which is now being built at the upper development, the lake thus performing the functions of a storage reservoir. The capacity of the power plant at Ile Malignes will, it is estimated, ultimately reach 390,000 hp. and will entail an expenditure of approximately $12,000,000. In all, close to a million horsepower can be developed at both sites.

The Quebec Development Company has, according to the *Financial Post* of Toronto, already disposed of 200,000 hp. to Price Brothers & Company, who have undertaken to build a new paper mill with a capacity of 600 tons daily. All machinery in this mill will be operated by electric power and the boilers heated electrically. It is estimated that this huge mill will cost in the neighborhood of $15,000,000.

The development at Ile Malignes or St. Joseph d'Alma is scheduled for completion in 1927 and may be ready sooner. It involves the expenditure of nearly $30,000,000. The development at Shipshaw River, however, will not be proceeded with until the whole of the possible output of the Grand Discharge plant is disposed of.

It is expected that the plant at Ile Malignes will produce the cheapest power ever developed in Canada. The question of the use to which this great volume of electric power can be put has been answered in Canada as follows:

"Undoubtedly this splendid plant will attract industries to the neighborhood, especially those that require large blocks of energy as well as the raw materials available in the district. While hydro-electric power is of outstanding value wherever it can be obtained and transmitted for reasonable distances, there is a natural tendency for it to be used near the point of production. In this particular case it should be recalled that mechanically produced wood pulp demands from 70 hp. to 80 hp. per ton. Of this amount, approximately 67 hp. is for grinding. Sulphite pulp consumes from 8 hp. to 30 hp. per ton, depending upon the process. From this it will be seen that there are immense power-consumption possibilities in the development of the extensive pulpwood areas in the surrounding district, which is already one of the most important pulp-producing areas in Canada. Other industries using pulp-wood products as their raw materials will also find the Lake St. John region a natural site for their mills.

"Many other industries will probably utilize the Ile Malignes power. In all likelihood, the heavy mineralized belt, reaching from Lake Superior across northern Ontario and including the famous Sudbury, Cobalt and Porcupine mining camps, will be found to extend across northern Quebec. Evidence to this end is shown in the value and the importance of the new mining field at Rouyn, and further prospecting may lead to mining discoveries to the eastward. It is not too much to hope that northern Quebec will develop into a mining district comparable with northern Ontario, and the hydro-electric power station at Ile Malignes may do much toward making this an accomplished fact. While the aim of the Quebec Development Company is to assist in attracting industries and to create a market for its power in the district, energy can, of course, be transmitted long distances. California is now dispatching electric energy efficiently over lines 360 miles long, and the same thing can without doubt be done in Canada."

Technical Educators Gather at Boulder

Research the Theme of the Society for the Promotion of Engineering Education, Which Turns Out in Force for Its Colorado Meeting

RESEARCH was the keynote of the thirty-second annual meeting of the Society for the Promotion of Engineering Education, held at the University of Colorado, Boulder, Col., on June 25-28, with the record attendance of 362. Long speeches were infrequent, and the discussions took the form of argument over the proper conclusions to be drawn from facts presented. The delegates were entertained in fine style, the mountain scenery proving a great attraction, and a visit of inspection was paid to the new hydro-electric plant at Boulder Lake.

LENGTH OF COURSES

Dean G. B. Pegram of Columbia University explained the present situation of the six-year engineering courses at his institution, which is that, although the work is very satisfactory, an almost negligible number of students are being graduated.

Prof. W. H. Burgess of Northwestern University read a paper by himself and Director J. F. Hayford entitled "Fifteen Years of Experience with a Five-Year Engineering Curriculum." Northwestern likes this plan, and the attendance, though small, has shown a 9 per cent annual increase; but only 13 per cent of the students who enter complete the fourth year and 8 per cent the fifth year, as compared with 35 per cent to 40 per cent in the average four-year college engineering courses.

In the discussion Iowa State College reported that more than 25 per cent of her engineering graduates have had college work preliminary to entering an engineering course to such an extent that they have completed five to eight years' total college work upon graduation.

Many engineering educators, it was made clear, believe that five-year or six-year engineering courses are needed for the adequate training of present-day engineers, but most of them also believe that such courses cannot be made successful without concerted action by all the best engineering colleges and by the engineering profession as a whole. Director W. E. Wickenden of the board of investigation and co-ordination, which is administering the fund of $108,000 created by the Carnegie Foundation for the study of engineering education under the direction of the society, strongly supported this view.

THE WICKENDEN INVESTIGATION

Mr. Wickenden thought the present attitude of engineering educators on the proper length of engineering curricula one of watchful waiting. The belief is growing, he said, that mere juggling with the details of the present four-year courses can effect only minor improvements and that any great advance in engineering education will require longer curricula.

Very comprehensive plans for the research work upon which the engineering colleges are entering were reported. Thirty-four colleges already have been visited and the field reconnaissance will be extended to forty more this year. A large number of colleges are co-operating by undertaking extensive collection of research data covering every phase of engineering education. Prof. H. P. Hammond of Brooklyn Polytechnic Institute has been engaged as assistant director to devote full time for the next fifteen months to this phase of the work. Director Wickenden plans to spend the first half of 1925 investigating engineering education in Europe. The United States Bureau of Education is collecting historical and other research data of engineering education as a part of the general program.

The co-operation has been secured of the great industrial organizations (through the Joint Industrial Conference Board) and of the great national engineering societies (through a joint council). These agencies will assist in making job analyses of the work of engineers in different occupations and of the numbers of engineering graduates required to meet the needs of the country.

NEW OFFICERS

The new officers of the society are: President, Dean A. A. Potter of Purdue; vice-presidents, Prof. R. S. King, Georgia Institute of Technology, and Dean G. B. Pegram, Columbia University. Members of the council for three years, Dean G. M. Butler, University of Arizona; Prof. H. Pender, University of Pennsylvania; Dean E. B. Norris, State College of Montana; Prof. W. E. Brooke, University of Minnesota; Assistant Dean H. H. Jordan, University of Illinois; Prof. W. H. Kenerson, Brown University, and Director W. E. Wickenden. The secretary, Dean F. L. Bishop of Pittsburgh, and the treasurer, W. O. Wiley of New York, were re-elected.

A new "division of deans and administrative officers" elected Dean H. S. Boardman of the University of Maine chairman, with Dean G. C. Anthony of Tufts College and Dean H. S. Evans of the University of Colorado as assistants.

The 1925 meeting of the society will be held at Union College, Schenectady, N. Y.

A. E. C. Coal-Storage Committee Report Published

Danger of coal famine will be eliminated, industry stabilized, railroads relieved and the consumers' coal bill ultimately cut by seasonal storage of coal, according to the report of the storage of coal committee of the American Engineering Council just made public. "The storage of coal," the report declares, "is essentially necessary as an aid to the solution of the national coal problem and is an economic and practicable means of insuring an adequate supply of coal as needed. If each coal consumer will adopt the policy of annually purchasing coal on a uniform monthly delivery basis, there will result automatically sufficient seasonal storage to guarantee coal to the consumer as needed. Furthermore, this policy will bring about a uniform demand for coal whereby the coal producer and carrier may establish uniform and standard production and shipment schedules. It will also remove the evils of intermittent operation of coal mines, frequent panicky market conditions and coal shortages due to inability of the carriers to meet peak demands."

The committee recommends that all consumers of bituminous coal purchase their fuel on an annual contract for yearly requirements with a provision that the coal be delivered monthly in equal allotments. It urges that consumers provide necessary storage facilities to meet the terms of such contract.

The report, given out by Ex-Governor James Hartness of Vermont, president of the American Engineering Council, comprises about 110,000 words. It was prepared by a main committee of the council, headed by W. L. Abbott of Chicago, working with the Department of Commerce, the United States Coal Commission and federal, state and municipal agencies as well as private enterprise. Sixty-seven sub-committees, functioning in every important industrial center in the United States and comprising 400 individual engineers, constituted the field organization which carried on the nation-wide survey for more than a year.

American Representatives at the Prague Conference

American participants and papers in the international management congress to be held at Prague, Czechoslovakia, on July 21 to 24, as outlined in the ELECTRICAL WORLD for May 17, page 1022, will include the following representatives of technical and industrial organizations:

L. W. Wallace, secretary American Engineering Council, "Coal Storage"; Maurice Holland, New York, "Industrial Research in the United States"; Fred J. Miller, Pennsylvania Public Service Commissioner, "Scientific Government"; W. F. Willoughby, Washington, "Management in the Federal Government"; W. E. Wickenden, New York, "Education for the Profession of Engineering"; Henry C. Link, New York, "The Human Element in Scientific Management"; E. S. Cowdrick, New York, "Industrial Relations in Scientific Management"; Howard Coonley, Boston, "General Budget Control of Operations"; George D. Babcock, Peoria, Ill., "Production Management"; C. K. Woodbridge, New York, "Sales Management"; Sanford Thompson, Boston, "Management in the Coal Industry"; Roy V. Wright, New York, "Management of Transportation"; A. R. Hatton, Cleveland, "City and State Management"; Channing Rice Dooley, New York, "Vocational Education"; George W. Coleman, Babson Park, Mass., "Advanced and Specialized Education for Commerce and Business Administration," and H. Lawrence Groves, commercial attaché in Prague, "Reorganization of the Department of Commerce."

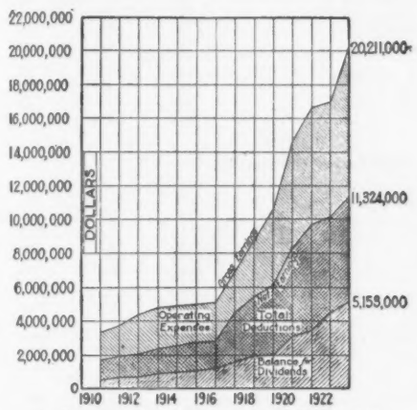
Among other American delegates to the Prague conference will be Calvin W. Rice, Harold V. Bozell and Louis Marburg, New York; C. E. Skinner, Pittsburgh, and Morris L. Cooke, Philadelphia.

Financial and Corporate

Financing at Home

Customer-Owned Stock Plays Large Part in Structure of Southern California Edison

A STUDY of the security sales of the Southern California Edison Company affords a striking example of what customer ownership has meant to the development of utility companies.



A CONTINUAL INCREASE IN EARNINGS

When in 1917 the company adopted as a fundamental policy the sale of its stock direct to its employees, consumers and the local public, there were 2,000 stockholders, mostly non-resident. Six years later the company's records showed a total of 65,636 stockholders, of whom approximately 90 per cent resided in the territory served by the company, more than 90 per cent of the company's permanent employees being holders of its stock.

This customer-ownership plan has made possible the large expansion program carried out by the company, which at the present time is serving 248,000 consumers direct from its lines and the equivalent of 150,000 more through energy sold wholesale to municipalities for resale. The gross revenue of the company for 1923 showed an increase of 20 per cent over that reached in 1922. The kilowatt-hour consumption showed a gain of 31 per cent over the total reached in 1922, while the average increase in kilowatt-hour output for the five years ended December 31, 1922, was only 9 per cent.

The remarkable expansion in the company's business during 1923 necessitated a material enlargement of the financial structure, which was accomplished last fall, when the total authorized capital stock was increased from $100,000,000 to $250,000,000 par value. The original preferred stock was continued at a total of $4,000,000—all outstanding. The authorized 7 per cent preferred stock was given a new name, series A 7 per cent, and increased from $36,000,000 to $60,000,000. The authorized common stock was increased from $60,000,000 to $125,000,000, and two new classes of preferred stock were created—series B, bearing 6 per cent dividend, $40,000,000, and series C, bearing 5 per cent dividend, $21,000,000.

Tennessee Power Merger

The Tennessee Power Company has added slightly to its system by the purchase of the franchises and properties of five small local utility companies which in the past have bought their energy from the purchasing company.

Included in the above merger are the Cumberland Power Company, Maryville Lighting Company, Madisonville Light & Power Company, Lenoir City Light & Power Company and the electric power properties of the Long Manufacturing and Tellico River lumber companies, all in small Tennessee cities. The total consideration for the acquisition of these properties, all of which are located in Tennessee, was $600,000.

Stability Through Diversified Service

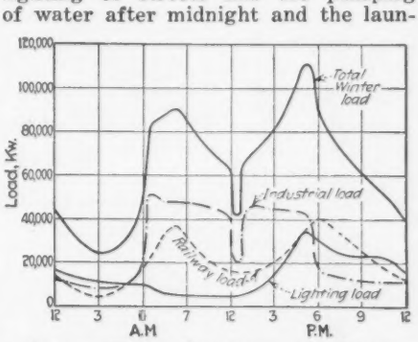
Possibilities of Off-Peak Business Are Far from Exhausted—First Cost of Equipment Presents the Obstacle Hardest to Surmount—The Rural Field

BY JOHN J. O'BRIEN
President H. M. Byllesby & Company

ANY business with a large number of customers who purchase something which they actually need every day, and who purchase from no other source, must be inherently a safe business. These are the conditions under which the electric light and power companies operate, and they are sufficient in themselves to explain the remarkable stability of such companies for the investment of capital.

In addition, however, we find a condition which still further protects the electric service companies from serious losses of business during periods of depression, namely, the great number of separate uses for which electrical energy is applied and the wide variation of many of these uses throughout the twenty-four hours of the day and night.

There are many diversity factors governing the business of supplying electricity. There is the diversity between the factories requiring power during the day and the homes requiring lighting at night, between the lighting of streets and the pumping of water after midnight and the laundries operating in residences during the forenoon, between the rock, sand and gravel business where building operations are active and certain manufacturing industries wherein conditions may be dull. In the summer power for irrigation, running fans, refrigeration, etc., often displaces a reduced demand for industrial power and lessened lighting requirements due to there being more daylight in the evening. About the time the factory quits for the day, and before the full lighting load is on, the electric range prepares the evening meal.



EARNING POWER STABILIZED AND PLANT INVESTMENT HELD DOWN BY DIVERSITY OF LOAD

The diversity of uses is extraordinary and is constantly growing. Added to the diversity of time through the twenty-four hours and through the seasons a situation results without parallel in any other industry.

"What is one man's meat is another man's poison." We have been going through a period of high wages for the craftsman and laborer and of reduced buying power on the part of the salaried worker—the clerk, teacher and others depending solely on their intellectual equipment. During this situation electric wiring, washing machines, irons, cleaners and other electrically operated appliances have gone into the homes of the manual workers. Should their comparative buying power be reduced, the turn of the brain worker—the "white-collar man"—will come again, and if he does not already possess the necessary equipment of electricity-using devices, he will soon acquire them.

It is the first cost of electricity-using equipment that arouses the resistance most difficult to overcome, whether the installation be in a modest cottage, a large factory or a great railroad system. Operating costs produce definite economies. Once the equipment—lighting, power and heating—is installed and paid for, it is used just as long as the householder can buy groceries and the factory can sell any of its output. People do not discard electric light or quit washing and ironing their clothing because they are hard up.

If certain very important experimental efforts now being made are successful, a new diversity factor will arrive before long in the widespread use of electricity on the farm. To make this practicable the farmer must become an industrial user of electrical energy. Transmission lines cannot serve him solely for lighting and domestic tasks. It must be made possible for him to employ electricity for power on a fairly liberal scale, and it is believed that much of the labor in farming operations can be done electrically.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par value of stocks is $100.)

Companies	Bid Price Saturday, July 5	Low 1924	High 1924
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	96	94	97½
Appalachian Power, 7 per cent	90	85½	90
Arkansas Light & Power 7 per cent	89	81	93
Asheville Power & Light 7 per cent	96	96	99
Carolina Power & Light 7 per cent	96	95½	100
Central Illinois Public Service 6 per cent	84	84	87
Central Indiana Power 7 per cent	84	80	87
Colorado Power 7 per cent	87	90	97
Connecticut Light & Power 7 per cent	99	99	102
Consumers' Power 6 per cent	86	85	90
Dayton Power & Light 6 per cent	83	84	90
Duquesne Light 7 per cent	*a* 105½	103½	107
Eastern Texas Electric 6 per cent	89	81	95
Empire District Electric 6 per cent	73	70	78
Fort Worth Power & Light 7 per cent	97	97	100
Great Western Power 7 per cent	98	96	98
Illinois Northern Utilities 6 per cent	82	82	87
Kansas Gas & Electric 7 per cent	93½	92	97
Long Island Light 7 per cent	98	95	98
Minnesota Power & Light 6 per cent	83	78	87
Mississippi River Power 6 per cent	82½	80	85
Nebraska Power 7 per cent	96½	89	97
Niagara Falls Power 7 per cent—25	*a* 27½	26	28
Niagara, Lockport & Ont. Power 7 per cent	102	99½	104½
Northern States Power 7 per cent	92½	91	97
Ohio Public Service 7 per cent	89	86	93
Pacific Gas & Electric 6 per cent	87½	85½	92½
Penn-Ohio Power & Light 7 per cent	88	84	93
Pennsylvania Power & Light $7; no par	96½	93	99
Penn. Public Service 7 per cent	90	90	100
Southern California Edison 8 per cent	115	112	119
Tennessee Electric Power, no par	76½	71	79½
Texas Power & Light 7 per cent	96½	95	96½
‡Philadelphia Electric 8 per cent—25	36½	29	36½
Utah Power & Light 7 per cent	96½	94	96½
Western States Gas & Electric 7 per cent	78	78	85
Yadkin River Power, 7 per cent	96½	94	96½
Holding Companies			
American Gas & Electric 6 per cent—50	46	41½	46
American Light & Traction	91	91	94½
American Power & Light 6 per cent	90	84	90
*American Public Service 7 per cent	84	84	88
American Public Utilities 7 per cent	77	73	85
American Water Works & Electric 7 per cent	*a* 99	89½	99
Carolina Power & Light	97	95½	99
Cities Service 6 per cent	72½	67	73½
Consolidated Gas 6 per cent—50	56	51	58
Continental Gas & Electric 7 per cent	85	69	85
Electric Bond & Share 6 per cent	100	96½	103
General Gas & Electric 8 per cent—no par	100	96	100
Illinois Power & Light 7 per cent	92	84	95
Middle West Utilities 6 per cent	86	80	89
National Power & Light 7 per cent—no par	89½	84	96½
North American 6 per cent—50	*a* 49½	43½	49½
Philadelphia Company 6 per cent—50	47½	42½	48½
Public Service Corp. of N. J. 7 per cent	98½	96½	100
Public Service Corp. of N. J. 8 per cent	103½	99½	108
Standard Gas & Electric 8 per cent—50	47½	46½	48
‡United Gas Improvement—50	57	55½	58
United Light & Power 6½ per cent—no par	77	75½	80
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	33½	22½	34
Appalachian Power—no par	79	66½	93
Arkansas Light & Power	42½	22	44½
Blackstone Valley Gas & Electric	71		
Brooklyn Edison	*a* 112½	107½	116
Buffalo General Electric	146	118	150
Carolina Power & Light	135	82½	150
Colorado Power	33	21	35
Commonwealth Edison	126	126	135
Connecticut Light & Power	99		
§Consolidated Gas, Electric Light & Power	*a* 118½	113	118½
Dayton Power & Light	108	70	115
Detroit Edison	*a* 104½	101½	108½
Eastern Penn. Electric	39½	36	40½
|| Edison Electric Illuminating of Boston	*a* 181	163½	181
‡Erie Lighting	29½	23½	30
*Kentucky Hydro-Electric	87½	85½	87½
Long Island Lighting	180	100	180
Mississippi River Power	28½	18½	30
Montana Power	66½	61½	68½
Niagara Falls Power—no par	45	45	48
Niagara, Lockport & Ontario Power—no par	54	45	59
Northern Ohio Electric—no par	10	5	16
Northern States Power	102	92	106
North Texas Electric	59	58	84
Pacific Gas & Electric	*a* 93½	90½	95½
‡Penn Central Light & Power—no par	*a* 59½	57	60
Pennsylvania Water & Power	107	98½	110
‡Philadelphia Electric—25	*a* 36½	29	37½
Public Service Co. of Northern Illinois	97	97	104
Puget Sound Power & Light	57	43½	60
South California Edison	95	95	106
Tampa Electric	142	134	148
Tennessee Electric Power—no par	36	20	40½
United Light and Power, "A"	33½	32	34
Virginia Power	50	16	50

Companies	Bid Price Saturday, July 5	Low 1924	High 1924
Holding Companies			
‡American Electric Power—50	62	22½	62½
American Gas & Electric—no par	70	43½	70½
American Light & Traction	126	115	136
American Power & Light	257	220	257
American Public Utilities	62	35	66
American Water Works & Electric	*a* 104½	40	104½
Carolina Power & Light—no par	138	103	146
Cities Service	134	134	155
Columbia Gas & Electric—no par	*a* 40½	33	40½
Commonwealth Power Corp.—no par	92½	56	97
Consolidated Gas—no par	68½	60½	69½
Continental Gas & Electric	57	49	61
General Gas & Electric	53	22	53
Lehigh Power Securities—no par	74½	37	68½
Middle West Utilities—no par	52	41	54½
National Power & Light—no par	130	60	140
Philadelphia Co.—50	*a* 49½	42½	49½
Power Securities—no par	13	4	14
Public Service Corp. of N. J.—no par	*a* 54½	39	54½
Standard Gas & Electric—50	35	27	36
United Gas & Electric (Conn.)—no par	33	14	42
Utah Securities	*a* 29½	16½	31½
BONDS			
Operating Companies			
Adirondack Power & Light 6s 1950	101	97½	101
Alabama Power 5s 1946	95½	90½	96
Appalachian Power 5s 1941	94	89	94
Brooklyn Edison 5s 1949	*a* 101½	97½	102½
6s 1930	104½	102½	106
7s 1930	*a* 107½	105½	109
7s 1949	*a* 109½	108	109½
Central Indiana Power 6s 1947	93	88	95
Commonwealth Edison 5s 1943	99½	95	100
5s 1953	99½	92	99½
§Consol. Gas, Elec. Lt. & Pwr. 4½s 1935	95	91	95
6s 1949	105	101½	105
6½s 1951	108½	107	108½
Consumers' Power 5s 1936	98½	94½	99½
Duquesne Light 6s 1949	*a* 106	103½	106½
Great Western Power 5s 1946	95	90½	96
Kansas City Power & Light 5s 1952	*a* 93½	89	94
Mississippi River Power 5s 1951	45½	92	96½
New England Power 5s 1951	98½	97	100
Northern States Power 5s 1941	93½	89½	94
Northern States Power 6s 1948	*a* 103½	96½	103½
Pennsylvania Water & Power 5s 1940	99	96	99½
‡Philadelphia Electric 5s 1966	*a* 100½	97	101½
5½s 1947	*a* 103	99½	103
5½s 1953	*a* 103½	98½	103½
6s 1941	*a* 106	103½	106½
Southern California Edison 5s 1939	98½	96	99
6s 1944	102½	100	103½
Cleveland Electric Illuminating 5s 1939	99½	98½	100½
Detroit Edison 5s 1933	*a* 99½	99½	101
5s 1940	*a* 98½	95	100
6s 1940	*a* 105½	104	106½
Montana Power 5s 1943	*a* 98	95	98
New York Edison 6½s 1941	*a* 111½	109½	112
Niagara Falls Power 6s 1950	*a* 104½	104	105½
Ohio Power 7s 1951	106	103	106½
Penn-Ohio Power & Light 7½s 1940	108	103½	108
Texas Power & Light 5s 1937	94	91½	94
Utah Power & Light 5s 1944	90½	87½	93½
Holding Companies			
Alabama Traction, Light & Power 5s 1962	76½	65½	78
American Gas & Electric 6s 2014	95	94	95½
American Power & Light 6s 2016	94½	91	94½
Amer. Water Works & Electric 5s 1934	*a* 91½	84½	92
Commonwealth Power 6s 1948	*a* 93	87	94½
Consolidated Cities Lt., Pwr. & Tr. 5s 1962	71	64	72
Illinois Power & Light 6s 1953	98½	95	99
United Light & Railways 5s 1932	91½	87½	91½
6s 1953	95½	92	95½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	*a* 95½	90	96½
*National Carbon	116½	115	125
†Wagner Electric	82	77	84
COMMON STOCKS			
Allis-Chalmers Manufacturing	*a* 53½	41½	53½
American Bosch Magneto—no par	*a* 30	22½	38½
Electric Storage Battery—no par	56½	50½	64
General Electric	*a* 244½	193½	244½
General Electric—10	11½	10½	11½
*Hurley Machine—no par	51½	48	53½
Manhattan Electric Supply—no par	43½	33½	45
*Vesta Battery—no par	19	15½	28
Wagner Electric	25	24	34½
Westinghouse Electric & Manufacturing—50	61½	55½	65
Worthington Pump & Manufacturing	*a* 27	23½	31½
BONDS			
Canada General Electric 6s 1942	*a* 105½	102½	105½
General Electric 3½s 1942	82	80	82
5s 1952	*a* 103½	100	103½
Robbins & Myers 7s 1952	76½	75½	91½
Wagner Electric Manufacturing 7s	99½	97	99½
Western Electric 5s 1944	*a* 98½	96	98½
Westinghouse Electric & Mfg. 7s 1931	*a* 108½	106½	109½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange. §Baltimore Stock Exchange.
a Bid price Wednesday, July 9.

Dividends Declared

The following quarterly dividends were announced by central-station companies and electrical manufacturing companies during the seven-day period ended July 8:

Name of Company	Per Cent	When Payable
American Light & Traction pf	1¾	Aug. 1
Central Power pf	1¾	July 15
Cleveland Electric Illuminating	2½	July 15
Edison Electric Illumin. of Boston	3	Aug. 1
Georgia Light, Power & Railways pf	1½	July 1
Lancaster County Ry. & Lt. com	$1.70	June 30
Lancaster County Ry. & Lt pf	1¾	June 30
Manchester Trac., Light & Power	2	July 15
Milwaukee Elec. Ry. & Lt. pf	1¾	July 31
Missouri G. & E. Service, prior lien	1¾	July 15
Mountain States Power pf	1¾	July 21
Newport N & Hamp. Ry. G. & E.	1¾	Aug. 1
Public Service Investment com.	1¾	Aug. 1
Public Service Investment pf	1¾	Aug. 1
Pub. Serv. of No. Ill. com. (par $100)	1¾	Aug. 1
Pub. Serv. of No. Ill. com. (no par)	$1.75	Aug. 1
Public Service of Northern Ill. pf	1¾	Aug. 1
Sierra Pacific Electric pf	1¾	Aug. 1
Southern California Edison pf	2	July 15
So. Indiana G. & E. 6 per cent pf	3	July 1
So. Indiana G. & E. 7 per cent pf	1¾	July 1
Tenn. Elec. Power 7.2 per cent pf	$1.80	July 1
United Gas & Electric com.	65c	June 30
Electric Vacuum Cleaner	1¾	July 1
Hurley Machine com.	$1.00	July 15
Magee Furnace first pf	1¾	July 15
Magee Furnace 8 per cent pf	2	July 15

Company Reports

Among the company reports issued during the past week for the month of May are the following:

Name of Company	Gross Revenue for May 1924	Gross Revenue for May 1923
Associated Gas & Electric	$267,729	$236,825
Blackstone Valley Gas & Elec.	380,371	377,873
Edison Electric Illuminating of Brockton	124,391	121,869
Federal Light & Traction Co.	438,430	429,594
General Gas & Electric	1,505,904	1,265,515
Los Angeles Gas & Electric	1,100,345	881,497
Metropolitan Edison	647,547	627,851
Mississippi River Power	282,076	273,922
Kansas Gas & Electric	455,348	455,987
Nebraska Power	306,398	297,287
Northern Texas Electric	220,216	237,928
Pacific Power & Light	265,028	246,861
Pacific Gas & Electric	3,680,214	3,143,141
Penn Central Light & Power	289,093	257,151
Puget Sound Power & Light	1,004,629	987,199
Philadelphia Company	4,728,617	4,869,283
Pennsylvania Edison	246,051	236,417
Savannah Electric & Power	151,315	129,320
Southern California Edison	1,909,017	1,677,339
Southwestern Power & Light	947,001	845,294

Executives Urged to Support Fraud Prevention

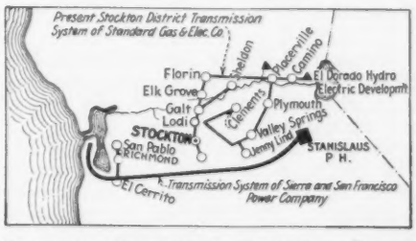
Henry L. Doherty, head of Henry L. Doherty & Company and president of the Cities Service Company, has called upon the men of the electrical industry to pledge their support to the work being carried on by the Associated Advertising Clubs of the World and other organizations for the prevention of frauds in the investment field. Up to the present time about forty "better business bureaus" have been organized by the Associated Advertising Clubs with the purpose of establishing cordial and intelligent working arrangements with business men and of reaching the wage earner through his employer and warning him to buy nothing without investigation. According to Mr. Doherty, actual investment frauds, mostly in the sale of stocks of fraudulent companies, total a billion dollars annually. In appealing to the men of the electrical industry to do their share in this great work Mr. Doherty says: "If the wage-earner is to be made an investor, he must have every safeguard thrown around him. You men should be the most zealous in the protection of the class of people to which you want to sell securities. You can't sell securities to the man who has already been robbed of either his capital or his confidence, and perhaps both."

Pittsburgh Utilities Corporation Reports Successful Year

The Pittsburgh Utilities Corporation, which was incorporated a year ago under the laws of the State of New York, reports for the first year of its operation, ended March 31, 1924, a net income of $1,369,242. The Pittsburgh Utilities Corporation is a holding company, owning 492,000 shares, or 52 per cent, of the common stock of the Philadelphia Company. The Philadelphia Company, in turn, controls, through entire common stock ownership, the Duquesne Light Company, which does practically all the commercial electric light and power business in Pittsburgh and in the greater part of Allegheny and Beaver Counties, Pa., a territory comprising approximately 1,000 square miles and holding approximately 1,750,000 people. The Pittsburgh Utilities Corporation has outstanding 385,000 shares of 7 per cent cumulative participating preferred stock—par value $10—and 240,000 shares of common stock, no par value. In the acquisition of the Philadelphia Company stock the company assumed $12,000,000 collateral trust 5 per cent gold bonds of the United Railway Investment Company.

Byllesby Firm Seeks Control of Sierra & San Francisco

H. M. Byllesby & Company have lately offered $65 a share for the prior preference stock of the California Railway & Power Company, which owns certain equity shares of the Sierra & San Francisco Power Company and of the Market Street Railway Company of San Francisco. The Byllesby company believes that a merger of the Sierra & San Francisco Power Company with properties adjacent to it will result profitably for the former company and will afford possibilities not possessed by the properties operated separately. With the purpose of eventually obtaining a controlling interest in the Sierra & San Francisco Power Company this offer was made for 50 per cent of the prior preference stock of the California Railway & Power Company at $65 a share, provided that an option until September 1, 1924, on the remaining shares may be obtained. The California Railway & Power Company is a holding company controlled through stock ownership by the United Railways Investment Company.



STOCKTON SYSTEM OF STANDARD GAS & ELECTRIC COMPANY AND PROPERTY IT SEEKS TO ACQUIRE

Dividend Rate to Be Increased.—The Middle West Utilities Company has declared a quarterly dividend of $1.50 a share on the preferred stock, payable July 15 to holders of record June 30. This is the last dividend at the rate of 6 per cent, the next dividend being at the rate of 7 per cent for annum.

Increase in Price of Preferred Stock.—The 7 per cent preferred stock of the Illinois Power & Light Corporation, which has been selling at $95 a share, will be increased to $96.50 a share after midnight of July 31, according to a recent announcement by E. Paul Young, head of the investment department of the company. The stock at the new price will yield 7.25 per cent.

American Gas & Electric Deal Not Completed.—The ELECTRICAL WORLD is advised that the announcement in last week's issue of the consummation of the sale of the Binghamton Light, Heat & Power Company and of the Sayre Electric Company to the American Gas & Electric Company was premature. No negotiations for their sale have been completed.

Toledo Edison Increases Stock.—The Toledo Edison Company announces that the proposed six-million-dollar increase in the capital stock has been approved by the stockholders. This new issue will consist of 7 per cent preferred stock and will increase the capital to $31,000,000. Acquisition of additional property is the underlying cause for this increase of capital.

Bonds Called for August.—The West Penn Power Company has called for payment on August 1 all of its outstanding five-year 6 per cent convertible gold debentures at par and accrued interest. Up to and including July 31 the company will issue to any holder of these debentures in payment of the principal a certificate for ten shares of 7 per cent cumulative preferred stock for each debenture of $1,000.

Stockholders Accept Exchange Plan.—Holders of more than $25,000,000 of the general mortgage 6 per cent bonds of the Public Service Corporation of New Jersey, or 75 per cent of the total outstanding, have accepted the offer of exchange for first and refunding mortgage gold bonds 5½ per cent series of the Public Service Electric & Gas Company, due in 1959. This exchange will afford an increase of one-half of 1 per cent income return. The completion of the plan depends upon the substantially unanimous acceptance of the exchange offer by the bondholders.

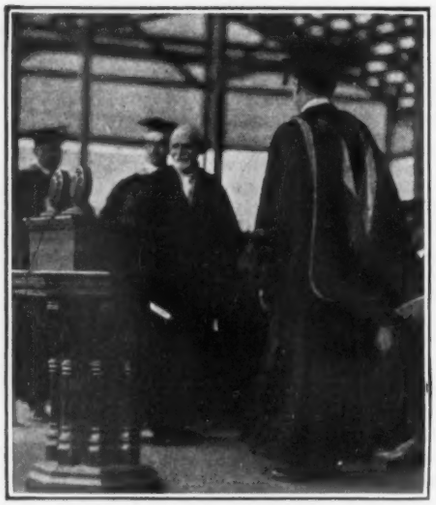
Reorganization for Wickwire-Spencer Steel.—A plan for the reorganization of the Wickwire-Spencer Steel Corporation by which the financial structure will be changed and a virtually new management installed has been prepared for

submission to stockholders at a special meeting to be called soon. It has the approval of the board of directors. Approximately $2,000,000 capital will be paid in under the plan. The new corporation will have $12,679,000 first mortgage bonds, $2,000,000 series A five-year 7 per cent notes, $3,650,000 series B five-year 6 per cent and 1,900,000 shares no par common stock.

Offer $6,000,000 New Utility Bonds.—A new issue of $6,000,000 first mortgage and refunding 6 per cent gold bonds of the Central Illinois Public Service Company was offered on Tuesday of this week at 97 to yield in excess of 6.25 per cent. The bonds are of series C and are secured by a mortgage covering all the property of the company, which supplies electrical energy for light and power to 224 communities in central and southern Illinois.

Issue of $9,000,000 Called in Advance.—The largest electric light and power issue called for payment during July in advance of maturity is the nine-million-dollar issue of the Consolidated Gas, Electric Light & Power Company of Baltimore 7 per cent bonds, due in 1931, callable at 102. Other public utility issues of this type recorded for redemption during the present month are the 5 per cent bonds of the Syracuse Light & Power Company, due in 1954 and totaling $6,905,700, and the 6½ per cent bonds of the Western Quebec Power Company, maturing in 1931 and totaling $250,000.

Central-Station Executive Is a Doctor of Engineering



THE honorary degree of doctor of engineering was conferred upon Alex Dow, president of the Detroit Edison Company, at the recent commencement exercises of the University of Michigan, "in recognition of his distinguished career as a successful engineer, an administrator of large affairs and a public-spirited citizen of high ideals." The photograph, printed by courtesy of the Michigan Public Utility Information Bureau, shows President Marion L. Burton of the university conferring the degree.

Briefer News

One and a Half Million Patents.—The one and one-half millionth patent issued by the United States government under the present Patent Office, organized in the year 1836, was granted on July 1 to Simon Lake.

Georgia Legislature Tables Resolution Aimed at Commission.—Efforts to reopen the fight on Georgia's Public Service Commission which raged in the State Legislature at its last annual session failed last week when the committee on public welfare after five minutes' consideration tabled a resolution calling for an investigation. A motion to reduce the commission from five to three members was lost in the same way.

Plants Serving Eleven Missouri Towns Are Merged.—The Public Service Company of Missouri has acquired the California Electric Light Company, supplying California, Bunceton, Tipton, Clarksburg, Speed and Bellair, for $210,500; the Versailles Light & Power Company, supplying Versailles and Stover, and the Harvey Light, Power & Ice Company and the Eldon Ice & Fuel Company, both of Eldon, for a total of $194,500; the electric light plant at Caldwell, Mo., for $22,500 and a transmission line from Caldwell to Bertig, Ark., for $86,000.

Algiers (La.) Lighting Plant Destroyed by Fire.—The plant of the South New Orleans Light & Traction Company, at Algiers, on the west bank of the Mississippi River opposite New Orleans, was struck by lightning on June 27 and destroyed. The officials of the company declined to appraise the damages sustained on either plant or equipment, but announced that the plant would be rebuilt. The South New Orleans Light & Power Company obtains its power from the New Orleans Public Service, Inc., and its lines extend to Amesville, Gretna, Harvey and Westwego.

Water and Power Act Initiative Petitions Filed.—Initiative petitions for the California state water and power act carrying 79,017 names were filed with the Secretary of State recently. The petitions carried approximately three thousand more names than were necessary. This insures a resubmission of the act to issue $500,000,000 in bonds to provide for state hydro-electric development which was overwhelmingly defeated two years ago. Former Congressman William Kent is directing the agitation for the proposed law. Following the filing of the petitions came a definite announcement of the formation of the California State Water & Power League to carry on a campaign in its favor. Chairmen for the various parts of the state have been named, with Frank Hitchborn as campaign manager and publicity director.

New York Edison Plans for Future Station of 700,000 Kva. Rating.—With the announcement of the General Electric Company of the receipt of an order from the New York Edison Company for two 60,000-kva. turbo-generators to be installed in its projected new power station is included the statement that this station is planned for an ultimate rating of 700,000 kva. When finished, therefore, it will take rank with the largest in the world, exceeding the ultimate capacity of the new Crawford Avenue station of the Commonwealth Edison Company in Chicago and that of the projected Richmond station of the Philadelphia Electric Company, on the Delaware River, by 100,000 kva.

Southern California Edison Company's Requested Surcharges.—The surcharges asked by the Southern California Edison Company to tide it over the drought period, which are now before the California Railroad Commission, would, it is estimated, yield the company approximately $2,971,000, leaving a net shortage of $789,000 for the nine-month period for which they are requested. These proposed surcharges call for the following increases: General lighting service, 1¼ cents per kilowatt-hour; street-lighting and flat-rate service, 20 per cent; cooking and heating service, 0.5 cent per kilowatt-hour; railway power service, 0.15 cent; industrial power service, surcharge for installations up to 99 hp., 0.5 cent; up to 999 hp., 0.35 cent, and over 1,000 hp., 0.15 cent; wholesale and resale power service, surcharge for installation up to 999 hp., 0.35 cent; over 999 hp., 0.15 cent; agricultural power service, surcharge 0.15 cent per kilowatt-hour. The Southern Sierras Power Company is also asking temporary increased rates.

Los Angeles Power Bureau Will Need $16,000,000 in Three Years, State Commission Says.—The California Railroad Commission has, upon request, rendered assistance to the Municipal Bureau of Light and Power of the Los Angeles Public Service Commission by making a survey of the capital requirements of the municipal power system. Its work has resulted in a recommendation fixing the sum of $16,000,000, or $5,000,000 less than the amount sought at the city election held in May, as covering the reasonable bond requirements of the municipal power system for a three-year period ending June 30, 1927. These, it says, should be issued as follows: $7,000,000 upon approval of the bonds by the voters, $5,000,000 July 1, 1925, and $4,000,000 July 1, 1926. In the application sent to the Railroad Commission the city's commission stated that none of the bond money would be used for acquiring the electric properties of the Los Angeles Gas & Electric Corporation or for building city lines that would parallel the lines of that system in any territory in which the company is exclusively furnishing service. It is the intention of the Public Service Commission of Los Angeles to present another bond issue proposal to the voters on August 26, when state and county primaries are held. The com-

mission declares that it has taken into consideration that the municipal system must make extensions of present transmission lines to serve the harbor district, that it must connect its lines with the steam plants of the Southern California Edison Company and that it must ultimately construct a belt transmission line in the western portion of the city.

Terrora Tunnel at Tallulah Falls Finished.—Independence Day was celebrated at the Terrora development of the Georgia Railway & Power Company near Tallulah Falls by the firing of the final shots that joined the two ends of the mile-long tunnel constructed to conduct the water from Lake Rabun to the Terrora power house now being built at the head of Tallulah Lake. The tunnel was started July 12, 1923. Work on the Terrora power house is progressing rapidly, and it is expected that the entire development will be ready for operation early in 1925.

Ottawa Fights Hydro-Electric Commission.—A fight is being waged between the Ontario Hydro-Electric Commission and the municipally owned hydro-electric system of the city of Ottawa, which purchases its power from the provincial system. The Ontario commission has ordered a 30 per cent increase in domestic lighting rates in Ottawa. The move is said to have been made because lighting rates were so low in the Canadian capital as to arouse the jealousy of other communities in the Ontario Hydro chain. The Ottawa commission is resisting the increase in rates, pointing out that it would mean higher profits and more business for the Ottawa Electric Company, a subsidiary of the Ottawa Light, Heat & Power Company.

Tennessee to Add 500 Miles of High-Tension Lines.—Power companies in Tennessee contemplate a program of expansion during 1924 which will add at least 500 miles of high-tension transmission lines to the existing systems. According to a survey recently completed by McGregor Smith, engineer for the Public Utilities Commission, it will be possible to transmit power through an interconnected system from Bristol to Clarksville and on to Hopkinsville, Ky., before the close of the year. Most important of the assured developments is that in west Tennessee, where power lines are assured to Martin from the Columbia western terminus of a hydro-electric line, and from Clarksville to Martin. From Martin the power system is to serve a group of cities, farms and rural districts. Other lines recently completed penetrate the coal regions of upper East Tennessee and will supply electrical energy to the mining industries in that section.

Spartanburg (S. C.) Gas & Electric Goes to Barstow.—W. S. Barstow & Company of New York have announced that they have completed negotiations for the purchase of the controlling common stock of the South Carolina Gas & Electric Company, serving Spartanburg, S. C., and adjacent territory. The negotiations were conducted on behalf of the General Gas & Electric Corporation, a Barstow property. There has been much disturbance in the central-station field in Spartanburg, which is reached by the lines of the Southern Power Company and where locally organized companies have also sought to gain a foothold. The purchase just announced follows other investments by the Barstow interests in Southern utility properties, principally the North Carolina Public Service Company, with which the Piedmont Power & Light Company was recently merged, and the Florida Public Service Company, which serves a territory in central Florida.

Power Available in Basins of Nehalem and Wilson Rivers in Oregon.—A manuscript report prepared by Department of the Interior, Geological Survey, on an investigation recently made to determine the possibility of developing power in the basins of the Nehalem and Wilson Rivers, which are within easy transmission distance of Astoria and Portland, Ore., says that no good reservoir sites were found, but that unusually heavy precipitation sustains the low-water flow well. No very attractive power sites were found on either river, yet considerable power can be developed in small units when a market becomes available. The total potential power on Nehalem River is 30,000 hp. for 50 per cent of the time and 5,500 hp. for 90 per cent of the time. The total potential power on Wilson River is 28,000 hp. for 50 per cent of the time and 5,000 hp. for 90 per cent of the time. The detailed report may be consulted at the offices of the Geological Survey in Washington, D. C., or Portland, and a copy will be sent to any district office on application to the director at Washington.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 5 issue, page 50, for latest list.]

Mississippi Electrical League—Gulfport, Miss., July 14-15.

Pacific Coast Electrical Supply Jobbers' Association—Del Monte, Cal., July 24-26.

Pennsylvania Electric Association—Bedford Springs Hotel, Bedford Springs, Pa., Sept. 3-6. H. M. Stine, 212 Locust St., Harrisburg.

Association of Edison Illuminating Companies—Griswold Hotel, New London, Conn., Sept. 8-12. P. S. Millar, 80th St. and East End Ave., New York.

Michigan Electric Light Association—Detroit, Sept. 9-11. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

New England Division, N. E. L. A.—Hotel Wentworth, Portsmouth, N. H., Sept. 10-13. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 15-17. O. A. Weller, 900 15th St., Denver.

Southeastern Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

Great Lakes Division, N. E. L. A.—French Lick, Ind., Sept. 24-27. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Electragists International—West Baden Springs, Ind., Sept. 29-Oct. 4. L. W. Davis, 15 W. 37th St., New York.

Luzerne County (Pa.) Company to Build New Station.—Official announcement is made that the Luzerne County Gas & Electric Company, which gives electric service to territory in the anthracite-coal district north, south and west of Wilkesbarre, Pa., where it has 21,369 electrical customers, is to be merged into a new corporation which, in addition to the present system of the company, will acquire a site for a new generating station and will immediately erect a modern plant thereon. This station will be constructed to house generating equipment rated at 40,000 kw., of which the first 20,000 kw. will be installed forthwith, making the total generating capacity of the company 50,000 kw. The Luzerne County company has hitherto been controlled by the American Gas Company of Philadelphia.

Chile Gets Water Power from the Andes.—According to recent announcement a new hydro-electric plant of 40,000 hp. built in the Andes Mountains has begun to send current into the city of Santiago, Chile. Two-thirds of the coal used in that country has been imported, and because of its ever-increasing cost, the development of hydro-electric stations is likely to be rapid. In addition to the 40,000-hp. plant just completed, other plants are under construction, and the ultimate electrification of the trans-Andean railways is planned. Thirty-nine electric locomotives, replacing one hundred steam engines, are already in use on the main line between Santiago and Valparaiso, a stretch of 230 miles. The water-power resources of the Andes Mountains are adequate, engineers say, for a vast potential development.

Operating Plans of Puget Sound Organization. — Unification of various important subsidiary interests with the parent organization is announced by President A. W. Leonard of the Puget Sound Power & Light Company, Seattle. The company now operates directly in its own name from the Canadian line through all the Puget Sound territory southward and across the Cascades into the Wenatchee Valley. Three subsidiary companies, acquired in the last two years, passed out of existence as separate organizations under the new plan. These are the Washington Coast Utilities, operating electric light and other service in various cities of the state, including Wenatchee, Arlington and Stanwood; the North Coast Power Company, whose passing has been already noted, operating various properties in the southern part of Washington, including Kelso, Chehalis and Vancouver, and in northern Oregon, and the Olympia Light & Power Company, operating light, power and street-railway service in Olympia. Under the present arrangements, according to President Leonard, the various cities heretofore served by these three companies will be assigned to the six districts under which the Puget Sound Power & Light Company is now operating, with headquarters at Seattle, Bellingham, Everett, Tacoma, Portland and Wenatchee, respectively.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in All Branches of the Electrical Industry

Owen D. Young, chairman of the board of directors of the General Electric Company, was elected a director of the Chamber of Commerce of the United States at the meeting of the board of directors of that body held on July 1, succeeding Lewis E. Pierson. Mr. Pierson was recently elected vice-president for the Eastern district.

Richard F. Grant, vice-president of the M. A. Hanna Company, Cleveland, and a former president of the Cleveland Chamber of Commerce, was elected president of the Chamber of Commerce of the United States at a meeting of the board of directors held on July 1, succeeding Julius H. Barnes of Duluth and New York. Mr. Barnes, having served two terms, was asked by the board to continue for another year, but he was unable to accept the office.

George C. Oxer has been appointed manager of the Eastern sales district of the Jeffrey-DeWitt Insulator Company and the Champion Switch Company with headquarters in New York. Colonel Oxer was formerly connected with the J. G. White Engineering Corporation and has had a long experience in the power field. During the world war he spent a year and a half in France with the Engineering Corps belonging to the American Expeditionary Forces.

Harry B. Gear, assistant to the vice-president of the Commonwealth Edison Company, has been elected to membership in the board of trustees of the University of Chicago. Mr. Gear was graduated from Cornell University in 1895 and has been in the service of the Chicago Edison Company and its successor, the Commonwealth Edison Company, ever since. Mr. Gear is an authority on electrical distribution and chairman of the safety codes committee of the American Institute of Electrical Engineers.

Millard F. Clement has been appointed local manager of the Orange County Public Service Company, Inc., Middletown, N. Y., which recently was placed under the management of Charles H. Tenney & Company, Boston. Mr. Clement was graduated in electrical engineering from the Worcester Polytechnic Institute in 1910, receiving the degree of E. E. there in 1912. To the spring of 1914 he was employed in inspection and construction work on the New York, New Haven & Hartford Railroad electrification and for a few months was on the staff of Gibbs & Hill, consulting engineers for the Pennsylvania and Norfolk & Western electrifications. He then became assistant engineer in charge of additional electrical construction on the New Haven system and during the war served as assistant electrical officer abroad the U. S. S. *New York* with the fleet in charge of interior electrical communication and fire-control systems. In 1919 he was assistant foreman of electrical car equipment on the suburban electrified zone of the Pennsylvania Railroad outside Philadelphia, later engaging in electrical research work for the McGraw-Hill Company. Since April, 1920, Mr. Clement has been assistant electrical engineer of Charles H. Tenney & Company, Boston.

W. P. Little Chairman of Accounting National Section

W. Paxton Little, who has been appointed chairman of the Accounting National Section of the National Electric Light Association by President Griffith, as announced in the ELECTRICAL WORLD of June 28, has been prominently identified for many years with this phase of association work. He has served as vice-chairman of the section which he has now been selected to head and as chairman of the Accounting Section of the Canadian Electrical Association. Twenty years' membership in the New York State Society of Certified Public Accountants added to experience gained through active participation in the affairs of the American Institute of Accountants and of the National Association of Cost Accountants has aided his equipment.

W. P. LITTLE

Mr. Little entered the service of the Cataract Construction Company as auditor in 1893, when this organization was constructing the works of the Niagara Falls (N. Y.) Power Company. He had charge of the accounts of the Niagara Falls Power Company at the same time, and in 1895 he was appointed assistant treasurer of that company. In 1905 he was elected treasurer of the Niagara Falls Power Company and of the Canadian Niagara Power Company, continuing as chief accounting officer of these companies since that date.

John D. Bomford, who promoted the States Power Company project, an electrical development in numerous towns northwest of Enid, Okla., and who obtained a franchise early this year in competition with the Elk City Ice, Light & Fuel Company, which franchise he later sold to the Inland Utilities Company of Kansas City, has become associated with the Inland Utilities Company. This company holds a franchise to construct and operate a light and power plant at Hobart. Mr. Bomford, it is understood, will personally supervise the installation of a plant in that city and look after the interests of the Inland Utilities Company in the section.

Obituary

Wilfred Campbell, one of the leading turbine engineers in this country, died in Schenectady on July 7 after an operation for appendicitis. Mr. Campbell was born in Manchester, England, in 1884 and came to America in 1907. During the war he was active in research work on submarine detectors and since 1919 had been investigating the action of large turbine wheels. In December he was awarded a Charles Coffin medal for meritorious service in his chosen work. Recently his investigation of the protection of steam-turbine disk wheels from axial vibration attracted much favorable attention. He had been associated with the General Electric Company since 1908.

Grayson B. McNair, formerly prominent in university engineering circles and more recently identified with several national manufacturers in the mountain region, died June 30 in Denver after a long period of ill health. Mr. McNair was a native of Indiana and a graduate of Purdue University. Later he became assistant professor of electrical engineering at Kansas State College. In 1917 he was appointed head of the electrical engineering department at Colorado College, which institution he left to become a lighting specialist for the Western Electric Company. He later joined the ranks of the Westinghouse company in a similar capacity and resigned about six months ago to become associated with Paul Douden in the Globe Electric Supply Company.

Herbert S. Potter, one of the best known electrical contractors in New England, died at Brookline, Mass., June 29. Mr. Potter was born at Newton, Mass., in 1868 and was educated at the Massachusetts Institute of Technology. About twenty-six years ago he went into the electrical contracting business with his father, the late John Sturgis Potter, and after the latter's death became proprietor of the organization, with offices in his own name at Boston. Mr. Potter was very highly regarded in central-station and jobbing circles as well as in his own branch of the industry and had long been intimately associated with the Edison Electric Illuminating Company of Boston in the carrying out of wiring campaigns and other installations, including some of the most important construction jobs in east Massachusetts.

Commission Rulings

Why Raising Rates May Cause Receipts to Decrease.—The Wisconsin Railroad Commission, replying to a request that the Merrill City Water Works Company should be permitted to amortize a loss it had suffered by reason of its failure to earn an adequate return under rates formerly established by commission orders, said: "While a great many court and commission decisions have been cited supporting applicant's recoupment proposition, there is a question whether, under the local conditions existing in Merrill, a schedule of rates placed at a high enough point to bring about this recoupment would not result in the discontinuing of the company's service by such a large number of consumers that it would not only fail to recoup past losses but even to cover current expenses. While the loss of a consumer may reduce the operating expense a small amount, such loss does not eliminate any of the fixed costs."

Tennessee Commission Upsets Thirty-Year Rates Agreed to by Municipalities. — Canceling certain portions of contracts referring to rates concluded between a group of municipalities in the western part of Tennessee which have sold their lighting plants to the Kentucky-Tennessee Light & Power Company, the Public Utilities Commission of Tennessee in a far-reaching order pointed out that the contracts fixed rates for a thirty-year period and that the officers of the municipalities had pledged their towns to pay rates for that period that would assuredly deserve a drastic reduction before its expiration owing to advances in the economical production of electric power. The commission's order made it plain that in its opinion the contemplated transmission-line service to farming sections and towns was desirable, but insisted that the towns should have better safeguards than those they themselves had imposed in their contracts with the company. It also upset discriminatory rates which it found in the schedules.

Excess Purchase Price Must Not Be Charged to Plant Account.—In evaluating the property of the North Missouri Power Company, the Missouri Public Service Commission required the company to charge off its plant account an excess amount paid in the purchase of utility property, the commission holding that purchasers paying an excessive price should be allowed to charge against the public a return upon the excess investment. The purchase at the full contract price agreed upon between the parties was allowed, however, on the ground that it was proper and equitable that some compensation be awarded holders of franchises and investors supplying small communities with electrical conveniences and that the commission should not arbitrarily interfere with the transfer of these properties nor intervene as to the price paid by parties competent to contract who desired to pay excess prices for what they purchased.

Unsafe Risks and Meter Deposits.—Asserting that a public utility cannot require from a consumer or a prospective consumer, before furnishing service, a deposit which is in excess of the meter deposit rule on file with and approved by the North Dakota Board of Railroad Commissioners, that body ordered the Hughes Electric Company to render service to a customer despite the utility's contention that by reason of past experience it considered him an unsafe risk. The company's further contention that the complaining customer was receiving service through a meter arrangement with a third party did not, the commission said, meet the issue, since the complainant had requested that service be furnished him through a meter installed in his apartment.

Recent Court Decisions

Contributory Negligence and Assumed Risk. — Buttrey vs. El Paso Electric Railway Company was an action for damages for death of an employee who came in contact with high-voltage electric wires while sweeping defendant's substation. The plaintiff had not assigned as negligence the company's failure to elevate transformers to a safe height, but the Court of Civil Appeals of Texas sustained the trial court in permitting the amendment of the petition to include this allegation. Evidence was held sufficient to justify submission to the jury of the issue whether the narrowness of a passageway was the proximate cause of the victim's death. Although employees assume ordinary risks, the court said, they do not, under Texas law, assume risks resulting from employer's negligence, although these risks may be known to them, and the question of contributory negligence is for the jury. (260 S. W. 897.)*

Temporary Rates During Appeal from Commission Orders — Dilatory Procedure Condemned. — The Supreme Court of Oklahoma in hearing an appeal from the McAlester Gas & Coke Company against a decision of the Corporation Commission of Oklahoma denying it increased rates declared that it had the power to permit the appellant utility to place in effect during the pendency of the appeal a temporary increase of rates to be prescribed by the court, upon the giving of a suspending bond to rebate its patrons all charges which the court may thereafter hold to be excessive, and that the court would unhesitatingly do this in event that it found there would be much delay in the final disposition of the case and that there was a strong probability that it would eventually hold the company entitled to a substantial increase in rates. The court would also, it declared, in cases where its jurisdiction was invoked compel the commission to make a final determination or an application for an increase of rates within a reasonable time. (244 Pac. 698.)

Operation of Utility Plants Not an Exercise of Government Functions.—Declaring that the construction, operation or maintenance of water and gas plants by municipal corporations is not an exercise of governmental functions, but is rather in the nature of a private enterprise for the convenience, advantage or benefit of the municipality, its inhabitants and property owners, the Supreme Court of Nebraska reversed a finding for the Metropolitan Utilities District in a suit brought by it against the city of Omaha to recover the cost of lowering gas and water mains. (198 N. W. 858.)

Domestic Customers Rightly Charged Higher Rate than Industrial Plants.—In finding confiscatory a gas rate set by the Kansas Public Utilities Commission for the Coffeyville Gas & Fuel Company, which brought action against the commission to force the withdrawal of the rate, the Supreme Court of Kansas decreed that in determining a reasonable rate for gas supplied by a utility consideration should be given to the cost of the producing or obtaining of gas for distribution, and the court held that under the evidence there were good reasons for allowing a higher price for a product supplied for domestic use, with the varying demands of consumers, than for that supplied and sold to industrial plants, where there is steadiness of demand. (225 Pac. 1036.)

Powers of Oklahoma Commission.—In Smith vs. Corporation Commission of Oklahoma, a suit occasioned by the commission's attempt to fix attorney's fees in a case heard before it, the Supreme Court of Oklahoma reversed the commission's order and in doing so took occasion to put on record the following syllabus of the commission's legal functions: "The Corporation Commission, as created by Article 9 of the constitution, is a body with, so far as the regulation of public service corporations is concerned, executive, judicial and legislative powers, but those powers are limited, and it has such jurisdiction and authority only as is expressly or by necessary implication conferred upon it by the constitution and statutes. The jurisdiction of the Corporation Commission is limited to those controversies wherein the rights of a public utility and the patrons thereof are involved. It has no power or jurisdiction to adjudicate differences between private litigants or purely private matters between a utility and a citizen. The Corporation Commission is without jurisdiction to fix or decree a lien upon funds in its hands belonging to patrons of a public utility or to fix the amount of an attorney's fee that should be paid by such patrons or the utility, or to determine controversies between attorney and client." (225 Pac. 708.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Are Our Prices Out of Joint?*

A Study of the Relative Cost of Material, Hourly Labor and Selling Prices of Electrical Apparatus in 1920 and 1924

By A. H. Timmerman
Vice-President Wagner Electric Corporation,
St. Louis, Mo.

As a result of the war labor rates were advanced to figures probably never reached before in the history of industrial organizations. A recent study made by the National Industrial Conference Board shows that the hourly rates of all industrial wage earners increased from a figure of 24½ cents per hour in 1914 to 60⅘ cents per hour in June, 1920. This represents an increase of 148 per cent. In other words, on the average, all industrial workers received in June, 1920, approximately two and one-half times as much per hour as they received in July, 1914.

During 1921 and the first half of 1922 this rate gradually decreased until we find that in July, 1922, the average hourly rate of wage earners in industrial plants was only 94 per cent in excess of the pre-war rate. From this time on, however, there has been a gradual increase, and the hourly rate is now 2.28 times the rate received in July, 1914. A further study indicates that in January, 1924, all male wage earners were receiving an hourly rate equal to 2.28 times that paid in 1914. Unskilled male labor was receiving 2.30, male skilled labor 2.26, and women were receiving 2.59 times the prewar rate.

Labor and Material Cut

In July, 1914, the average hourly rate of all wage earners in electrical manufacturing was 27.2 cents per hour. The gradual increase reached a peak in December, 1920, of 62 cents per hour. From this time on until the middle of 1922 there was a gradual decrease to 49.2 cents per hour. At this point a gradual increase began until the hourly rate reached a figure of 60.6 cents in January, 1924. Taking the July, 1914, hourly rate as 100, the peak reached was 228, while the rate in January, 1924, was 223. It will be seen from this that in the electrical industry we are today paying virtually the peak wages of 1920, and this peak is 123 per cent in excess of the pre-war rate.

Material costs are made up of labor, either direct or indirect, with the exception of that part which represents the cost of capital employed in industrial business. One should, therefore, expect that material prices have shown a fluctuation somewhat similar to the fluctuation shown in the cost of labor. As a matter of fact, and taking the 1920 price as 100, the 1924 index of all material used in the manufacture of a certain line of electrical apparatus is 77.67, while that of 1914 is 47.1, and the cost of the material in 1924 is approximately 65 per cent above that of 1914. This gives an index of 77.8 per cent, which is a good check on the index of 77.67 derived by the other method. It can be said in general, therefore, that our material costs of 1924 are 78 per cent of what they were in 1920 and 165 per cent of similar material in 1914.

A corresponding figure for another line of electrical apparatus, quite different from the line referred to, gave an index of 80 for the 1924 material cost. It would, therefore, seem reasonable to assume in a general way that the cost of material in 1924 is approximately 78 per cent of the cost in 1920. The problem therefore is to produce electrical apparatus today with hourly labor rates which are 98 per cent of the peak figures in 1920 and material costs which are 78 per cent of the 1920 figures. On apparatus in which labor and material enter equally there should therefore be in 1924 a labor and material cost which is 88 per cent of the 1920 figures.

Relative Selling Prices

Let us now examine into the relative prices at which electrical apparatus was sold in 1914 and 1920 and at which it is being sold in 1924. To make this comparison we will take several more or less distinct classes of apparatus:

Squirrel-Cage Motors. — Assuming the selling price in 1914 as 100, we find that the relative price of a line of such motors in 1920 was 169 and in 1924 was 106. In other words, the selling price of squirrel-cage motors today is approximately what it was in 1914. Calling the standard of comparison (the 1920 price) 100, the 1924 price of squirrel-cage motors is 63 per cent. In other words, with an hourly labor rate of 98 per cent and a material cost of 78 per cent of corresponding figures in 1920, the selling price of squirrel-cage motors is 63 per cent of the 1920 price.

Single-Phase Motors. — Assuming as 100 the 1920 price of repulsion-induction single-phase motors of 1 hp. rating and larger, the 1924 index is 69 per cent, while that of 1914 is 58½ per cent.

Fractional-Horsepower Motors.—Using prices of ¼-hp., ½-hp. and ¾-hp. motors, in equal quantities, for May, 1920, and May, 1924, and placing the 1920 selling price at 100, the 1924 selling price is 48, and this notwithstanding the fact that labor rates are 98 per cent and material costs 78 per cent of what they were in 1920 .

A similar index for distribution transformers is 76.

The index showing relative costs of a complete line of alternating-current motors of all kinds and capacities within the Electric Power Club limits shows April, 1924, selling prices as 67 per cent of the 1920 peak figures.

What Is Wrong?

A first glance at the figures given would seem to indicate that the losses of the electrical manufacturers under these conditions would be very heavy. There are, however, three compensating circumstances:

First—Labor is more efficient.

Second—Shop efficiency has been much increased.

Third—Redesign of electrical apparatus has made possible reductions in both labor costs and material costs.

In order to place costs and selling prices of squirrel-cage motors on the same relative basis as in 1920, it would be necessary to have reduced labor hours on a given size of frame by 25 per cent and to have increased horsepower ratings by one size on the average. Even with this reduction in costs, the profit will be exceedingly meager, notwithstanding the assumption that all overhead costs have been reduced on the same

*Abstract of a paper presented before the Electric Power Club, Absecon, N. J., May 27, 1924.

percentage basis. On fractional-horsepower motors the situation is still more serious.

To sum up the problem: If we rerate all frames upward one size and in addition reduce our labor hours by 25 per cent under what they were in 1920, with material prices and hourly labor rates as they are at present, the profit will still be less than in 1920. It behooves all of us therefore to give very serious consideration to the above facts.

What is wrong with the electrical manufacturing industry that we should buy material at 78 to 80 per cent of the 1920 prices and sell it in the form of electric motors at somewhere between 48 and 69 per cent of the 1920 figures?

The Farm Plant Situation

Better Times on the Farm and Developments in the Automobile Industry Give Good Promise of a Greater Market—How the Central Station Can Help

BY R. K. SCHREIBER
President Universal Products Company, Oshkosh, Wis.

AFTER a long period of serious discouragement due to the depressed financial condition of the farmer, the manufacturers of farm-lighting plants are enjoying a gradual improvement in business and the general outlook for them is decidedly encouraging. Automobiles have held the stage for a long time in the agricultural country. The farmer has been buying motor cars. But with sixteen million cars in use today in America, making one car to every seven people, the point of saturation is being very closely approached, and the present condition of the automobile industry would seem to indicate a recognition of this fact and an expectation that sales from now on will be principally for replacement.

LESS SPENT FOR CARS

An analysis of the automobile market does not show a lack of buying power, but the continued expansion and increased production has caught up with, then exceeded the demand. Moreover, there used to be a time when the owner felt that he had to have a new car each year, but with the improvement in design and construction of automobiles, he now uses his car from three to five years. Again, by reason of better roads, cars today are not pounded to pieces so quickly. Obviously, therefore, if the let-up in the automobile business is not due to the impairment of buying power, a proportion of the money formerly spent for this purpose will be diverted to other channels. A larger and larger proportion of the money formerly spent for automobiles will go for improved machinery to cut down labor on the farm, and foremost among all will be the electric plant to provide light and power. Farmers want electric light and by making the car last longer can afford to install it.

The electrical contractor is the logical man to sell this equipment to the farmer. Every sale of a lighting plant carries with it a job of wiring, usually bigger and more profitable than the average city home job. It carries with it also the sale of fixtures and appliances. The principal difficulty is to find a dealer who in addition to his trade knowledge has some selling ability and the business judgment to exercise it. It would seem that a great many electrical contractors conduct their business principally on a basis of profit on labor, ignoring the fact that the profit on the sale of merchandise is often larger and may be made to carry the profit of labor along with it without any extra selling effort. The electrical contractor, in fact, will habitually make several calls to obtain a contract that will amount in all to about $150 or $200, whereas in the same amount of time he could sell a farm-lighting plant with a spread of from 25 to 30 per cent for profit on the sale and obtain with it a complete wiring job.

NEGLECT BY DEALER

To illustrate, the writer recently sent to an electrical contractor an inquiry for a plant of large capacity. The prospective purchaser was not more than one mile from the dealer's place of business, but several weeks later in checking up it was found that the dealer had not called on this prospective customer, the reason given being that he was busy on a wiring job. The sale of this plant was made, and it carried with it the sale of an electric range and a number of small electrical appliances besides the wiring job. This contractor could have had that business as well as not and could have sold it in no more time than he gave to the single wiring job on which he was busy.

The sales resistance on lighting plants during the past four years has not been any greater than the sales resistance of other commodities—not actual necessities—selling primarily to the agricultural trade. With the noticeable improvement in the farming industry we believe that the lighting-plant business will show great development in the next few years, and the dealers that properly equip themselves to take care of this business will profit by it.

UTILITY TIE-IN

This problem affects the central station as well. There is a direct tie-in between these two branches of the electrical industry. In the final analysis the pioneering work done by the manufacturers of farm-lighting equipment benefits central-station companies when their distribution lines reach the isolated farmers. Until that time the service now rendered by individual lighting plants may be considered a stepping-stone toward central-station service. Far-thinking central-station executives realize that the advance work rendered by farm-lighting equipment manufacturers is exactly parallel to the new-business promotional activities of their own organizations. With more than 6,000,000 farm homes in the United States without any electrical service whatever, the field is plenty large enough to warrant many years of development work, without any clash between the two branches of the industry over territories to be served.

Although a few executives appreciate these relationships, many do not. These could, however, well afford to boost the sale of farm-lighting equipment instead of remaining in a passive attitude. They have much to gain and little to lose by such a moral support. Where central-station managers know that they cannot possibly reach certain territories within a period of say five or ten years, they should cooperate with the farmers who are asking for service. They could build up much good will by showing these farmers how electrical service could be furnished them by means of an individual plant. For keeping the farmer on edge by promising him distribution lines within a year or so, when the executives them-

selves know right well that it will not be possible to extend these lines in a period of five years, is wrong. Some of the strong feeling among farmers against central-station companies is largely a result of this evasive attitude.

CENTRAL-STATION INSPECTION NEEDED

I submit a concrete instance of how central-station companies might help in boosting farm-lighting equipment sales. Although most of the present-day equipment installed on farms operates at 32 volts, the loss of such a wiring investment to farmers upon obtaining central-station service would be practically nothing if central stations would assume some advisory inspection service to assure the farmer of obtaining a real wiring job. In the past contractor-dealers have been too prone to install wiring on the farm which would hardly pass city electrical inspectors. Because this city inspection service does not range into suburban territories, a central-station supervisory control should prove of great benefit when the time comes for power lines to run past these farms which have used individual lighting units. There would be plenty of copper capacity for the increase in voltage from 32 to 110, because the 32-volt systems are usually wired with No. 12. The only question remaining would be the insulation required for this higher voltage, which, if standard high-grade equipment is used, will afford ample protection on 110 volts. Central stations could do much to make the farmer feel that it is important to get a real wiring job so that he could change over to central-station service without losing his investment in the 32-volt installation. It would be to the central station's advantage to see to it that proper wiring equipment is installed in the beginning.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE electrical business throughout the country has held a fairly even course this week, with a steady volume of sales but no marked movement of commodities in any section. General business continues in an uncertain mood, although improvement in the cotton situation in the South and better wheat and corn prices in the Middle West have brought encouragement in those sections. The final action of the Democratic National Convention is also expected to bring confidence to trade and industry, and the fact that stocks on the shelves of wholesalers and retailers are very low while loans are down and money is plentiful inspires a universal confidence that business will be good this fall. Fan business continues active and good sales are reported in the South and on the Coast. In the Middle West and East fan sales are running below last year.

In New England central stations have been actively buying pole-line material, but wiring supplies are dull, in spite of the fact that building contracts this week are 50 per cent higher than last year. The volume of business in the New York district has been good, with construction lines active, and retail business has held up well. In the Southeast elevators and commercial lighting fixtures are prominent in the week's sales. Several large orders for reactors and high-tension fuses were placed in the Middle West, and a quantity of busbar copper was purchased, although the week was generally quiet. Tile and fiber duct have been in good demand on the Coast, although business there on the whole is slow.

Copper Production in Utah Increased in 1923

UTAH'S copper production jumped from 79,665,563 lb. in 1922 to 210,118,291 lb. in 1923, according to figures compiled by the United States Geological Survey. By reason of this advance Utah became the third largest copper producer last year. It was fourth in 1922. Arizona was the leading copper producer in both years, and Montana was second each year, but Utah in 1923 passed Michigan, which held third place two years ago.

Large Increase in Manufacture of Lighting Equipment in 1923

RETURNS received from 732 manufacturers of lighting equipment show products to the value of $180,926,265 made during 1923, according to a census conducted by the Department of Commerce. In 1922 products to the value of $76,402,193 were reported by 521 manufacturers. The inquiry, which is the second of an annual series, was expanded to include equipment designated as miscellaneous lighting equipment, which group was not included in reports for 1922. The total value of this miscellaneous group, $90,783,509, constitutes slightly more than 50 per cent of the total value of all products reported in 1923.

COMPARISON OF VALUE OF LIGHTING EQUIPMENT MANUFACTURED IN 1923 AND IN 1922

Seven hundred and thirty-two manufacturers reported in 1923 and 521 in 1922.

Class of Product	Value 1923	Value 1922	Per Cent Increase or Decrease
Residence lighting fixtures	$53,811,191	$41,621,505	29.3
Commercial lighting fixtures	12,213,639	7,267,941	68.0
Industrial lighting fixtures	4,901,468	7,718,846	-36.5
Street-lighting fixtures	1,068,685	3,948,308	-72.9
Marine lighting fixtures	959,523	525,678	82.5
Shades for lighting fixtures	17,188,250	15,319,915	12.2
Miscellaneous lighting equipment	90,783,509	*	....

* Not reported in 1922.

In the manufacture of lighting fixtures the largest increase is shown for marine lighting, 82.5 per cent, followed by commercial lighting, 68 per cent, and residence lighting, 29.3 per cent. Marked decreases are shown in street-lighting fixtures and industrial lighting fixtures. An increase of 12.2 per cent is shown in the manufacture of shades for lighting fixtures. The complete comparison is shown in the accompanying table.

Fractional-Horsepower-Motor Prices Very Low—Demand Fair

ALTHOUGH there has been an increase in the demand for fractional-horsepower motors for several years past, due to the increased number of motor-driven devices on which they are used, it has not kept pace with the manufacturing capacity established during the boom period of 1919 and 1920, when the demand exceeded the capacity. At present there is ample capacity to handle a great deal more of this business than is available. There has been a slackening in demand due to the general business conditions and the unstable price situation in the fractional-horsepower-motor market. Sales of different companies vary from 60 per cent of those made last year up to this date to nearly the same volume. The manufacturers of devices that include a fractional-horsepower motor have for some time been buying for resale only and are not carrying so much stock as they had formerly been doing.

With normal business conditions a constant increase in the demand can be expected, due to an increase in the number of applications and an increased use of the devices now available which require these motors. It is the general consensus of opinion of the manufacturers that the price trend, which has been downward for some time, can hardly be expected to go any lower. Competition in an overcrowded market has been the chief cause of the present low prices, which allow very little margin of profit.

With an improvement in general business conditions and the increased demand which will result from the larger use of devices requiring these motors, an upward turn in prices is expected. Some of the smaller manufacturers have maintained prices at a low level,

so that early this year price reductions were made by the larger companies; but it is doubtful whether such reductions increased the sales of the companies making them. Deliveries are at present very good, standard machines being available from stock, and labor and material are easy to obtain.

Quiet Week in Metal Market—Little Price Variation

LITTLE business was transacted in the metal market the latter part of last week on account of the holiday. There have been practically no price variations, in spite of the small amount of buying, indicating that there is little weakly held metal on the market. Copper is somewhat weaker, the large producers quoting 12⅞ cents, but some sellers have reduced quotations to 12¾ cents, and while no great amount of metal is available at this figure, it appears to be sufficient to meet current needs. There are a few substantial inquiries in the market, and buyers are making every effort to

NEW YORK METAL MARKET PRICES

	July 2, 1924 Cents per Pound	July 9, 1924 Cents per Pound
Copper, electrolytic	12⅛	12⅛
Lead, Am. S. & R. price	7.00	7.00
Antimony	8⅛–8⅜	8.35
Nickel, ingot	27	27
Zinc, spot	6.15	6.15
Tin, Straits	44⅛	43⅜
Aluminum, 98 to 99 per cent	27½	27½

shade prices, but they seem to be in no hurry to place orders. The foreign demand continues good.

The price of lead remains at 7 cents, which is the price generally quoted by all producers. There has been little business done, but producers are willing to accumulate stocks in anticipation of a good fall trade. In Europe there is still a strong demand for lead, the lead-covered cable industry and the paint and pipe manufacturers taking very large quantities.

Sales of zinc have been very small. There is encouragement to hold prices at present level as there has been an important cut in production. With ore at $39, there is no inclination for smelters to reduce prices.

There is little buying of tin in America, but the price is being held up by the London interests and the metal is not freely released.

Better Feeling Prevails in New England District

A PERSISTENT optimism characterizes the electrical outlook in the New England district, notwithstanding the depressed condition of the great textile industry. Inquiries are increasing and sales of Boston jobbers are holding up well in diversified lines. By and large, a good deal more trade could be handled without straining stocks, the only shortage reported being in certain high-grade radio material.

Last week's building contracts in New England totaled $10,626,200 against $7,215,600 a year ago, this being the best report for this calendar week in twenty-four years. One jobber reports motor sales ahead of last year's figures, but this is not general. Central-station buying of pole-line material is active, but interior wiring supplies are dull for the moment. Nonemployment and layoffs in certain industries have hit the electric appliance trade hard in some localities, but in the larger cities a healthy sales total is mounting and retailers are not discouraged. Interest in domestic refrigeration is still growing. Collections are fair and prices firm except on wire.

Demand Still Uneven, but Business Good in New York District

SALES in the New York district continue to maintain the same level, with the demand uneven, but the volume of business transacted is considered good. Central-station construction programs are assisting largely in sustaining business, although one or two companies are holding off on purchases.

A slight improvement was noted among the jobbers, there being a very good demand for construction material taken as a whole. Staple lines are moving well, with no particular material in especial demand. Fan sales are not so large as last year, and there appears to be a wide difference in volume of sales among various jobbers. Approximately a 3 per cent reduction was made in the price of rubber-covered wire last week, and this week armored conductor cables dropped about $1 per 1,000 ft. in price, and in addition double-strip is now listed at the same price as single-strip. Manufacturers are still indulging in price reductions, although prices in general are holding firm.

Middle West Business Marks Time Again

ELECTRICAL business in the Middle West experienced a quiet and uneventful week. Central-station construction, although restricted to some extent, continues the prime factor. Very little equipment is being purchased at the present time; none the less, several sizable orders for reactors and high-tension fuses were placed. A quantity of busbar copper was also purchased. Maintenance purchases have improved, and it is noticed that the Chicago power load has increased somewhat, indicating that manufacturing is reviving.

Reports originating in some sections of the territory are that the excessive rains have destroyed certain crops. A feeling of depression is, therefore, noticeable in those states. Other sections, particularly in the North and West, report good crop conditions and the industry is optimistic. Business in the jobbing trade has been inactive, if not dull. Appliances, particularly washing machines, have been in good demand, but general sales have fallen off. Radio has been very inactive.

Prices have been steady, with the exception of code wire, on which reductions from 4 per cent to 2 per cent have been made. Several manufacturers of wiring devices have revised their price lists, making reductions on some items and increases on others. Building is not progressing so rapidly as is indicated by the permits being obtained and is, in fact, temporarily restricted.

Business Holding Up in Southeast—Weather Favorable

WEATHER conditions for the past two weeks have been quite favorable for cotton in the Southeast, and a more optimistic spirit is evidenced throughout the section. Agricultural reports show cotton crop conditions as 75 per cent of normal on June 25, the highest percentage on that date since 1918. If this percentage is maintained, healthy business conditions in the cotton belt will result next fall. Textile conditions show little change, and the general impression is that it will take the fall demand to bring about any material improvement.

Retail electrical business in the rural sections of north Georgia has picked up materially in the past few weeks, and electrical jobbing sales are holding up well throughout the territory, despite the fact that business generally showed a smaller volume than for the corresponding period last year. There has been considerable activity in the elevator field with business in the alternating-current apparatus of the 250-ft.-per-minute and higher-speed type predominating. The gearless type of machines have been in good demand, and there are at present a number of jobs pending which will use this class of apparatus. Warehouse elevators and auto lifts are reported very slow.

The recent reductions in "Mazda" lamp prices have caused jobbers to lay in heavier stocks than usual and to put extra effort in their sales promotion in order to keep up the dollar volume. Pole-line hardware, which has been active of late, is showing a lull. Some sizable orders for commercial lighting fixtures have been received recently, one jobber reporting an order for $12,000.

Business Slow on Pacific Coast—Retail Trade Better

BUSINESS on the Pacific Coast has slowed down as a result of the holidays. Retail trade shows some stimulation, however. Longer terms and other special inducements are being offered to promote increased sales of small appliances. Tile and fiber duct are in good demand, fiber conduit especially so, and stocks are very low. All lines of staples are showing a fair movement and dealers report a good fan business, especially in the San Joaquin Valley district of California. There has been rather brisk buying of additional fire-protection equipment, stimulated by heavy losses which have occurred this year.

The value of June, 1924, building permits for Los Angeles was $10,292,542; San Francisco, $3,899,374; Oakland, $2,527,008. The values for June, 1923, were: Los Angeles, $15,074,446; San Francisco, $4,213,346, and Oakland, $2,650,946.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Worthington Pump Sells Two Pennsylvania Plants

The Worthington Pump & Machinery Corporation, New York, has sold its Hazleton (Pa.) works to the Pennsylvania Power & Light Company and its Pittsburgh works to the Pittsburgh Piping & Equipment Company. It is understood that the price received is more than $500,000, which is believed to be in excess of the amount at which these properties have been carried on the company's books.

Disposal of the properties is in line with the company's policy of concentrating its manufacturing facilities in its larger works and follows the sale three months ago of the Cudahy (Wis.) works to the Allis-Chalmers Manufacturing Company.

Warren Clock Company Expanding Facilities

Total sales of the products of the Warren Clock Company, Ashland, Mass., for the first six months of 1924 exceeded those of the corresponding half of last year by about 110 per cent, according to C. E. Davis, sales manager. The demand for secondary clocks of the synchronous motor-driven type for use on systems where the frequency is controlled by a master clock is so active that the company is considering the erection of a new factory within about a year. Production facilities are being increased by the relocation of one department in another building and the installation of new machinery. About 10,000 sq.ft. of additional floor space will be utilized.

The following new sales representatives have been appointed by the company: Lockwood & Almquist, 220 East Forty-second Street, and the Simplex Time Recording Company, 69 Cortlandt Street, both of New York; also Austin & Moore, 87 Wilbur Avenue, Long Island City, N. Y.

General Electric Uses Storage Battery Locomotive

A 75-ton storage-battery locomotive, the largest yet built in this country, has been put in operation at the Schenectady plant of the General Electric Company for use on the interconnecting track systems of the plant and for operation in restricted areas where overhead or other outside current collection is impossible or impracticable.

This locomotive is a double-truck, four-motor unit with a central operator's cab and batteries arranged in compartments at either end. It is equipped with contactor control and automatic airbrake equipment. The storage battery, which consists of 100 cells, has a total capacity of 1080 amp.-hr., or 216 kw.-hr. The locomotive is built so that it can be operated with a pantograph, collecting power from overhead wires.

Coghlin Heads New Kelvinator Organization in New England

A new distributing organization affiliated with the Kelvinator Corporation, Detroit, was established July 7 at 749 Boylston Street, Boston, under the name of Kelvinator Boston Inc., Peter A. Coghlin of Worcester, Mass., being president and treasurer. The new company will control the distribution of this product throughout the territory of the Edison Electric Illuminating Company of Boston and in eastern Massachusetts with the exception of the Lawrence-Haverhill and the Brockton-Fall River districts.

Sales throughout Maine will be handled by this organization. A stock will be carried at Boston, and installations and servicing will be cared for through an agreement with the Boston Edison company, the latter confining itself to retail sales development work. Ernest W. Strong, formerly of the American Writing Paper Company, Holyoke, Mass., has been appointed general manager of the Kelvinator Boston organization.

Boston Jobber Opens Display Room

An attractive display room was opened on Monday of this week by the Sager Electrical Supply Company at 157 Franklin Street, Boston, on the street floor of the new Boston Chamber of Commerce Building. Quarters 56 ft. long by 26 ft. wide have been fitted up for the demonstration of lighting fixtures in booths and for the exhibition of portable lamps, general socket devices of lighter character and electric toys. The store will be in charge of James Suter, and the main store of the company will continue to function at 201 Congress Street, Boston, with branch stores at Brockton and Lynn, Mass. G. O. Lloyd is general sales manager.

Cramp & Sons Receive Order for Two 28,500-Hp. Turbines

The William Cramp & Sons Ship & Engine Building Company has been awarded a contract by the Pennsylvania Power & Light Company for two 28,500-hp. vertical I. P. Morris turbines with governors and two 105-in. x 84-in. Johnson valves. These turbines are for use at the Wallenpaupack hydro-electric development in Pennsylvania and will operate under a head of 330 ft.

Other contracts recently received include two 5,250-hp. units for the Niagara & Lockport company for its Lighthouse Hill development, two 10,500-hp. turbines for the Northern New York Utilities, Inc., Soft Maple development; one 1,500-hp. unit for the Great Northern Paper Company, Anson (Me.) plant, and five 800-hp. turbines for the Illinois Northern Utilities Company, Dixon, Ill. The units being built for installation at Dixon are of the single-runner type and will operate under a head of 8 ft.

The Pelton Water Wheel Company of New York and San Francisco, a subsidiary of the Cramp company, has also secured a contract from the Southern California Edison Company for one 22,500-hp. and one 35,000-hp. impulse turbine. The latter unit will be the highest-powered impulse wheel ever constructed.

Westinghouse Incoming Orders for First Quarter Show Increase

The Westinghouse Electric & Manufacturing Company booked approximately $40,300,000 new business in the quarter ended June 30, the first of the 1924-25 fiscal year. This represents an increase of 6 per cent over the previous quarter's total of $37,860,000, and compares with $47,649,000 for the same period in 1923.

Sales billed for the quarter amounted to about $40,960,000, against $44,680,000 in the preceding three months and $35,094,000 in the same quarter a year ago. Unfilled orders as of June 30 amounted to approximately $61,254,000, against $61,914,237 on March 31, 1924.

Liberty Electric Occupies New Factory

The Liberty Electric Corporation, manufacturer of panelboards, switches, water-pumping systems, radio equipment, etc., announces that it has purchased and is now occupying a new factory at Stamford, Conn. The company was formerly at Port Chester, N. Y. The new factory, with over 35,000 sq.ft. of floor space, gives the company room to accommodate the greatly increased manufacturing facilities it needs.

Addition to Westinghouse Plant at Mansfield, Ohio

It was announced recently by the Westinghouse Electric & Manufacturing Company that arrangements have been completed for increasing the company's works at Mansfield, Ohio, by the addition of two buildings which will be of steel construction, and devoted entirely to manufacturing heating appliances and devices. One of the buildings will consist of a one-story steel structure, while the other building will be four stories and either of steel or mill-type construction. It is estimated that the new additions will increase the floor space of the Mansfield plant by 140,000 sq.ft.

The Belden Manufacturing Company, Chicago, cord and specialties department has just issued a new price list as of June 1, 1924.

The Gamewell Company, Newton Upper Falls, Mass., manufacturer of fire and police-signal alarm systems, is arranging a new stock issue of 60,000 shares of its $50 common, the proceeds to be used for improvements and additions to its plant and equipment.

The Westinghouse Electric & Manufacturing Company has recently placed on the market a low-priced light and power generating plant, known as type E-30, equipped with a 3,000 watt-hour battery. The plant has a capacity of 750 watts at 32 volts and operates on kerosene or gasoline. Natural gas may also be used as a fuel by the attachment of a special device.

The Leach Company, Oshkosh, Wis., manufacturer of line construction tools, concrete mixers, etc., announces the appointment of C. B. Crutchfield, Hopkinsville, Ky., as Southern field sales manager.

Fairbanks, Morse & Company, Chicago, manufacturers of electric motors, etc., have taken options on property at North Bristol, Conn., previously used as a shipbuilding plant. It is planned to establish an Eastern branch works at this location, and a number of improvements and extensions will be made upon acquisition of the land.

Harvey Hubbell, Inc., Bridgeport, Conn., manufacturer of wiring devices, has designed a laboratory socket and switch testing machine for use in testing their products. The machine operates at about ten cycles per minute and is entirely automatic.

The Electric Machinery & Manufacturing Company, Minneapolis, has awarded a contract for the construction of a two-story and basement addition, 135 ft. x 184 ft., estimated to cost $75,000.

The Pelton Water Wheel Company, San Francisco, since July 1 has taken over the Pacific Coast agency for the De La Vergne Machine Company, New York, manufacturer of large-capacity oil engines and refrigerating machinery. An experienced representative of the De La Vergne company will occupy offices with the Pelton company in San Francisco.

The Western Electric Company has awarded to J. Livingston & Company, electrical contractors, New York, a contract involving approximately $60,000 for furnishing and installing electrical work for the power plant, coal and ash handling buildings and the drag-scraper building at the Kearny (N. J.) works now under construction.

Gilfillan Brothers, Inc., Los Angeles, Cal., manufacturers of radio equipment, have purchased the plant and business of the Radio Service Laboratories, Asbury Park, N. J., and will consolidate with this organization. It is proposed to extend the manufacturing facilities, and three plants, at Los Angeles, Kansas City, Mo., and Asbury Park, will be operated in the future.

The Thermal Electric Company has just been incorporated at Cincinnati by Fred E. Davis and Edward Harris to manufacture thermo-electrical products. It is capitalized at $50,000 preferred stock and 1,000 shares common stock with no par value.

The Maine Electric Company, Portland, Me., manufacturers and distributors of steam and electric hoists and derricks, coal-handling plants, etc., has opened a Philadelphia office at 814 Walnut Street, with F. V. Wetherill, in charge.

The Taylor Stoker Company, Ltd., Philadelphia, announces the purchase by the Abitibi Power & Paper Company, Ltd., of two Taylor Stokers for its mill at Iroquois Falls, Ontario. These stokers are in addition to the eight Taylor stokers now installed.

The General Electric Company has awarded a contract for the construction of a one-story addition to its Erie (Pa.) Works, to be used as a general mechanical and service building, work on which will proceed at once.

The Hance-Parker Manufacturing Company, Meriden, Conn., manufacturer of electrical appliances, announces that it is now placing on the market a line of electric cigar lighters for home and office use, known as the "Electric Smokerlite."

The National Metal Molding Company, Pittsburgh, has placed on the market a line of boxes with clamps attached to comply with the new rule of the fire underwriters. Loom clips are also being manufactured for use with boxes not provided with clamps. The company is also offering an adjustable bar for supporting boxes between beams, which is known as the "National Bendit box bar."

The Spray Painting & Finishing Equipment Sales Company has been formed at Boston, with headquarters at 60 High Street, to distribute the pneumatic spraying apparatus developed by the Spray Engineering Company, Boston, and used in meter departments, in vehicle applications and other fields. F. H. Hills is president.

The Benson Superpower Corporation of Delaware and the **Benson Engineering Company, Ltd.**, of England have been succeeded by the International Benson Patent Verwertungs Aktiengesellschaft of Zurich, Switzerland, with a share capital of 50,000 francs. It will be under the management and control of the Siemens-Schuckertwerke at Siemensstadt, Berlin, where all inquiries should henceforth be addressed.

The Mica Insulator Company, 68 Church Street, New York, has awarded a contract for the construction of a two-story addition to its Schenectady works on Dock Street, to be 90 ft. x 100 ft., estimated to cost about $32,000. A portion of the new building will be equipped as a furnace department.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Adjustable-Speed Motor

A self-contained, adjustable-speed, alternating-current motor with shunt characteristics, the change of speed being only moderate as compared with the change of load, has been developed by the General Electric Company. The new motor, known as type BTA, is now available for use on three-phase, 60-cycle circuits at 220, 440 or 550 volts, but motors for other speed ranges and frequencies as well as for two-phase service will also be made.

The motors now being marketed range from 3/1 hp., 1,650/550 r.p.m., to 50/16.7 hp., 1,250/415 r.p.m., the lower horsepower sizes being six-pole machines and the larger eight-pole. The motors are designed to be thrown on the line with brushes in low-speed position. Speed is varied by brush-shifting and can be arranged for manual, mechanical or electrical remote-control operation. With brushes at low-speed position, the motor is designed to give 150 per cent to 200 per cent of normal torque at starting with 125 per cent to 160 per cent full-speed line current. The maximum torque at low speeds is from 150 per cent to 200 per cent of normal torque and increases for the high-speed position to from 300 per cent to 400 per cent of normal torque.

The efficiency of this motor remains nearly constant over the greater part of the speed range, but is somewhat lower at very low speeds. At synchronous speed the power factor is about the same as that of an induction motor of similar rating. By using a secondary resistance and contactor a creeping speed of half the listed minimum speed may also be obtained.

Busbar Bender.—A busbar or flat-metal bender for bending metals of flat shape from ¼ in. to ⅝ in. thick has been placed on the market by the Albert & J. M. Anderson Manufacturing Company, Boston. The bender is portable and is for use in an ordinary vise. The bending member is a smooth roller which does not mark the metal, and without changing it any angle up to 90 deg. may be bent. The bending arm is sufficiently long to give plenty of leverage and great bending power. It is made in three sizes to take metal 4 in., 8 in. and 10 in. wide.

High-Vacuum Pump.—A two-stage high-vacuum pump for exhausting incandescent lamps and radio tubes and for various industrial and scientific purposes has been developed by the Eisler Engineering Company, Newark, N. J. The pumps proper are immersed in oil, the level of which is kept a little above all the mechanical parts. It requires ¼ hp. when cold and operates at 375 r.p.m. This type of pump does not require any adjusting and will produce a vacuum to 0.0001 mm. on a McLeod gage. The weight of the complete pump is 110 lb., and it is 15 in. long, 8½ in. wide and 11½ in. high.

New Trade Literature

ELECTRICITY FOR THE FARMER.—The General Electric Company, Schenectady, N. Y., has issued a booklet entitled "The G-E Farm Book," in which it calls attention to the things that electricity can do for the farmer and the sources from which he may obtain electricity. Illustrations are given of various uses of electrical devices on the farm.

MANUFACTURING PLANT.—The E. W. Bliss Company, Fifty-third Street at Second Avenue, Brooklyn, N. Y., is distributing a booklet which gives a general description and illustrations of its new Brooklyn works.

SALES HELPS.—The Society for Electrical Development, Inc., has issued manual No. 104, entitled "Electric Irons and Ironers," which is one of a series of reference books, all of them designed to assist the industry to promote the idea of "Do it electrically."

ELECTRIC HOIST, PORTABLE LOADER AND LOCOMOTIVE CRANE.—The Link-Belt Company, 910 South Michigan Avenue, Chicago, has issued three catalogs, known as books Nos. 580, 650 and 670, covering the "Link-Belt" electric hoists, portable loaders and crawler and locomotive cranes, respectively.

AIR FILTERS.—The Midwest Air Filters, Inc., 100 East Forty-fifth Street, New York City, has issued a bulletin entitled "Air Filters for Compressors and Internal-Combustion Engines," which contain instructions for installing and cleaning the "Midwest" air filters and also tables giving capacities and sizes and charts showing how to determine proper size for filter.

TRANSFORMER.—The Pittsburgh Transformer Company, Pittsburgh, is distributing bulletin No. 2,031, covering the "Pittsburgh" expansion-tank-type transformer. Bulletin No. 2,030 issued by the company describes copper-alloy steel tanks for "Pittsburgh" transformers.

ELECTRIC FURNACES.—Bulletin No. 90 issued by the Leeds & Northrup Company, 4,901 Stenton Avenue, Philadelphia, describes and illustrates the "Hump" method for heat treatment of steel and the "Hump" electric furnace equipment for correct hardening.

LUBRICATION.—The McCord Radiator & Manufacturing Company, Lubricator Division, 2587 East Grand Boulevard, Detroit, has issued two booklets on lubrication, one entitled "The Economy of Better Lubrication," which covers its class B lubricator adapted to small engines, air compressors, steam pumps, etc. The other, known as class BA catalog, describes the part lubrication plays in the operation of heavy machinery, such as steam shovels, cranes, hoisting engines, etc.

OIL SWITCHES AND CIRCUIT BREAKERS.—The Condit Electrical Manufacturing Company, South Boston, Mass., is distributing bulletins Nos. 454, 455 and 456, covering its type D-13B and type F-11 oil switches and circuit breakers and its electrically operated mechanism for automatic closing and reclosing of oil switches and circuit breakers.

ELECTRIC BENCH GRINDER.—Bulletin No. 1,305-A issued by the Hisey-Wolf Machine Company, Cincinnati, describes its new "Hisey" two-wheel, 6-in. electric bench grinder.

FANS AND BLOWERS.—Bulletin No. 1,002 issued by the American Blower Company, Detroit, describes the various types of its "Sirocco" fans and utility blowers. Bulletin No. 1613 describes its "Ventura" disk fans.

ELECTRIC FANS.—The Emerson Electric Manufacturing Company, 2,012 Washington Avenue, St. Louis, is distributing bulletin No. 4072-A, covering the various types of its oscillating and non-oscillating fans.

GRINDING, BUFFING AND POLISHING MACHINERY.—The Cleveland Armature Works, Inc., has issued catalog No. 315, which describes and illustrates its "C. A. W." electric grinders, buffers and polishers.

FITTINGS FOR PIPE STRUCTURES.—Circular No. 1,676 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes its complete line of structural pipe fittings.

PRECISION TORSION BALANCES.—The Roller-Smith Company, 233 Broadway, New York City, is distributing bulletin No. 240, covering its precision torsion balances.

RESISTANCE STARTER.—Bulletin No. 640 issued by the Allen-Bradley Company, Milwaukee, covers its type H-1, 852 semi-automatic resistance starter.

REFRACTORY LININGS.—The Quigley Furnace Specialties Company, Inc., 26 Cortlandt, Street, New York City, has issued a new bulletin entitled "Hytempite in the Power Plant," which describes and illustrates some of the many applications of Hytempite in refractory construction and maintenance.

GENERATING SETS.—Catalog No. 800 issued by Engberg's Electric & Mechanical Works, St. Joseph, Mich., describes and illustrates the "Engberg" alternating-current generating sets.

TRANSMISSION, SWITCHING AND PROTECTIVE EQUIPMENT.—The Railway & Industrial Engineering Company, Greensburg, Pa., has issued a new catalog, published in the form of nine separate bulletins, covering its products, including transmission, switching and protective equipment for all voltages. Special attention is called to its interchangeable-unit equipment for outdoor service.

PLUGS AND RECEPTACLES.—Bulletin No. 2,055 issued by the Crouse-Hinds Company, Syracuse, N. Y., covers its "Arktite" circuit-breaking plugs and receptacles.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Oporto, Portugal (No. 10,737), for storage batteries.

An agency is desired in Beirut, Syria (No. 10,735), for electric generating plants and electric lamps.

Agencies are desired in Amsterdam, Netherlands (No. 10,744), for electric heaters, soldering apparatus and other electrical specialties and for mica and insulating materials; (No. 10,795), for mahogany ebonite radio panels; (No. 10,763), for radio sets and accessories.

An agency is desired in Paris, France (No. 10,731), for electric motors.

Purchase and agency is desired in Valencia, Spain (No. 10,738), for electrical novelties and for radio sets and accessories.

Purchase and agency is desired in Mukden, China (No. 10,734), for radio sets and accessories.

Purchase and agency is desired in Vienna, Austria (No. 10,739), for electric smelting furnaces for steel and other metals.

Purchase is desired in Dehra Dun, India (No. 10,740), for electric tramcars and supplies for rack railway.

An agency is desired in Havana, Cuba (No. 10,736), for electric trucks for warehouses.

Purchase and agency is desired in Nagoya, India (No. 10,733), for electric baggage and warehouse trucks.

Purchase is desired in Indore, India (No. 10,732), of water-turbine plant for generating electricity.

An agency is desired in Lille, France (No. 10,766), for first-class electric automobiles and electric trucks.

An agency is desired in Havana, Cuba (No. 10,736), for electric trucks of ½-ton capacity.

An agency is desired in Paris, France (No. 10,731), for refrigerating machinery.

An agency is desired in Bombay, India (No. 10,809), for metals, such as copper, brass, nickel, spring steel and high-speed steel.

TWO SYNDICATES FORMED FOR ELECTRICAL DEVELOPMENTS IN CARACAS, VENEZUELA.—Two syndicates have been formed, according to *Commerce Reports*, to undertake the construction of two electric power plants to furnish electricity for light and power in the city of Caracas. The plans call for a hydro-electric plant on the Caruao River, while a second plant, to be equipped with crude-oil engines of 2,000 hp., will be erected at Caracas. The necessary capital has been subscribed by financial groups of Venezuela.

EXTENSIONS CONTEMPLATED TO THE SHANGHAI (CHINA) POWER PLANT.—The French Tramway & Electric Light Company, *Commerce Reports* states, contemplates increasing the output of its electric power plant to 10,000 kw. About half of the proposed increase will be made during 1924 and the remainder during 1925. Improvements are contemplated to the street railway system, including double-tracking of the Avenue Joffre line from Route Voyron to Route Say Zoong.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

SKOWHEGAN, ME.—At a special town meeting held recently the voters authorized the Selectmen to enter into a contract with the Central Maine Power Company for street lighting, which provides for the installation of a new lighting system, to cost approximately $2,000 per year more than the present system.

BOSTON, MASS.—Steps have been taken by the South End Merchants and Property Owners' Association for improvements and extensions in the street-lighting system in this section. H. E. Hagan is a member of a committee in charge.

PROVIDENCE, R. I.—The Narragansett Electric Lighting Company has filed plans for the construction of an addition to its steam-driven electric plant to increase the capacity about 50 per cent. Jenks & Ballou, Providence, are engineers.

Middle Atlantic States

ALEXANDRIA BAY, N. Y.—Private extensions to the electric light system, to cost from $30,000 to $50,000, are under consideration by a special committee of property owners. W. H. Warburton, Thousand Island House, is interested.

BOONEVILLE, N. Y.—Under the terms of a new contract entered into by the Electric Light Commissioners and the Northern New York Utilities, Inc., Watertown, the local municipal electric plant will be connected with the transmission system of the latter. The work will include the erection of a transmission line, about 1¼ miles long. The cost is estimated at about $20,000.

BROOKLYN, N. Y.—The Brooklyn Edison Company has filed plans for the construction of a substation at 304-12 Pearl Street, to cost about $40,000.

ELMIRA, N. Y.—The Elmira Water, Light & Railroad Company has acquired a site at East First Street and Railroad Avenue on which it proposes to erect a substation for the distribution of electricity in the downtown section.

ELMIRA, N. Y.—Steps have been taken by business men and property owners on Baldwin Street for the erection of ornamental lamps on that thoroughfare from Water to Church Street and the removal of all poles and wires from the street.

JAMESTOWN, N. Y.—The Board of Public Welfare contemplates the installation of an ornamental lighting system at the General Hospital park and ground, to cost about $10,000.

NEWARK VALLEY, N. Y.—The Binghamton Light, Heat & Power Company is negotiating for the purchase of the municipal electric light plant. If taken over, extensive improvements will be made.

NORTH TONAWANDA, N. Y.—Plans are under consideration by the City Council for the installation of an ornamental lighting system on Oliver Street, to cost about $10,000.

READING, N. Y.—The Dundee (N. Y.) Electric Light Company contemplates extending its electric service to the town of Reading. The work will cost about $25,000 and will include transmission lines and a substation.

ST. GEORGE, N. Y.—The J. G. White Engineering Corporation, New York City, has been engaged by the Staten Island Edison Corporation to design and construct substations at Livingston, Eltingville, Atlantic, Arrocher, Clifton Junction, Dongan Hills and St. George, with transmission line from Livingston to Clifton Junction, and thence to Eltingville and Arrocher, and also addition to power plant at Livingston, including the installation of a 15,000-kw. unit with necessary auxiliaries.

SALAMANCA, N. Y.—Plans are under consideration for the installation of an entire new street-lighting system in the principal streets of the city, to cost about $35,000. Iron poles and Novalux lamps will be used. C. R. McCann is president of the water and light department.

SYRACUSE, N. Y.—The Board of Contract and Supply has awarded a contract for the installation of an electric traffic control system, to cost about $125,000, to the Syracuse Lighting Company.

ASBURY PARK, N. J.—The Eastern Jersey Power Company has issued $1,250,000 in capital stock, a part of the proceeds to be used for extensions and improvements in its system.

KINGSTON, PA.—The Luzerne County Gas & Electric Company has issued $3,000,000 in bonds, part of the proceed to be used for the construction of a power station to house generating equipment of 40,000 kw., of which the first unit of 20,000 kw. will be installed at once. Plans are under consideration for providing additional funds for the construction of the station and the erection of about 12 miles of 66,000-volt transmission lines to connect with the present system.

LAKEWOOD, PA. — The Pennsylvania Power & Light Company has secured franchises for light and power service at Lakewood and Lakewood Park and will connect its Haucks and Delano substations with new transmission lines, which will also be extended to the Mahanoy Tunnel district.

MERCER, PA. — The Mercer County Heat, Light & Power Company has contracted with the Board of County Commissioners for light and power service at the court house and other county buildings, to be operative during the summer months, when the county plant will be closed down. The power company is said to be planning for transmission-line extensions.

SEWARD, PA.—The Penn Public Service Corporation, Johnstown, has engaged Dwight P. Robinson & Company, Inc., New York City, to design and construct an extension to its plant near Seward. The work will consist of the installation of two new boilers, equipped with preheaters and fans, new boiler-feed pumps and a new stack. The stoker equipment will be the exact duplicate of that already installed.

MANCHESTER, MD. — The Glen Rock Electric Light & Power Company has been granted permission to acquire the local electric light and power system. Extensions and improvements are contemplated.

CHARLESTON, W. VA.—In an item published in the issue of July 5 it was stated that the Virginia Power Company was reported to have purchased the property of the Portsmouth (Va.) Public Service Corporation. It should have been Portsmouth, Ohio.

CEDAR BLUFF, VA.—Bonds to the amount of $6,000 have been voted, the proceeds to be used for the erection of a transmission line from Richlands to Cedar Bluff. The town, it is understood, plans to purchase electricity from the Appalachian Power Company, Bluefield, W. Va.

PORTSMOUTH, VA. — Tentative plans are being prepared for the construction of two electric power plants to be operated in connection with two electrically operated pumping stations. J. P. Jersey is city manager.

WASHINGTON, D. C.—Bids will be received by the supervising architect, Treasury Department, until July 24, for lighting fixtures for public buildings.

North Central States

ADRIAN, MICH.—The Citizens' Light & Power Company has contracted with the Southern Michigan Light & Power Company, Hudson, to furnish energy for local service. A transmission line is being erected from Adrian to Hudson.

MARCELLUS, MICH.—The Council is negotiating for the sale of the municipal electric power plant and will secure service from the Michigan Gas & Electric Company, which plans to extend its transmission system here.

CINCINNATI, OHIO.—Plans are being prepared by the Union Gas & Electric Company for a substation to be erected at 2,729 Ogden Street, to cost about $131,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, room 226, City Hall, until July 16 covering all the city's requirements of dry batteries for a period of one year. Separate bids will also be received at the same time and place covering all the city's requirements on cartridge, plug, plain and refillable fuses and wire for a period of one year.

TOLEDO, OHIO.—The Libbey-Owens Sheet Glass Company, Nicholas Building, plans to install electric power equipment at its proposed local grinding and polishing plant, to cost about $100,000.

SIDNEY, IND. — The property of the Farmers' Mutual Electric Light & Power Association, which has been furnishing electricity to Sidney, Collamer and the farmers between these places, has been acquired by the Northern Indiana Power Company, Kokomo. Transmission lines will be erected from North Manchester, and the present lines of the company will be rebuilt to carry 6,600 volts.

TERRE HAUTE, IND. — The Indiana Electric Corporation plans to erect additional transmission lines from its generating plant near the city limits to Indianapolis.

ROCK ISLAND, ILL.—The City Council is considering entering into a contract with the People's Power Company which will provide for the installation of a new lighting system, to cost about $27,000.

AMERY, WIS.—The Railroad Commission has granted the Wisconsin Hydro-Electric Company authority to issue $950,000 in bonds, part of the proceeds to be used for extensions and improvements contemplated to its system. Work, it is reported, will soon begin on the company's undeveloped power site on the Namakagon River, which it is estimated will develop about 1,750 hp.

OSHKOSH, WIS.—Plans are under consideration by the Wisconsin Public Service Corporation for the installation of a 5,000-kw. turbine in a steam-driven plant at Oshkosh.

BRAINERD, MINN. — The Northern Pacific Railroad Company, St. Paul, has plans under way for the construction of a local power plant, to cost about $400,000. H. E. Stevens is chief engineer.

OWATONNA, MINN. — The date has been postponed from July 8 to July 17 for receiving bids for the construction of a 1,000-kw. steam-driven electric generating plant, complete with electric distribution and street-lighting system, and a steam-heating system for the business district. Plans and specifications may be obtained from Arthur L. Mullergren, Gates Building, Kansas City, Mo. M. R. Cashman is chairman of the Utilities Commission.

SAC CITY, IOWA.—The Iowa Light, Heat & Power Company will soon begin work on the erection of a 33,000-volt transmission line from Sac City to Lake View, to cost about $20,000.

CARUTHERVILLE, MO.—The Arkansas-Missouri Power Company has issued $664,000 in bonds, the proceeds to be used for the acquisition of light and power plants in this section and for proposed extensions.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service until July 22 for a union market and automobile service repair and garage building, to cost about $850,000. A cold-storage and refrigerating plant will be installed in the market section and a general machine shop in the garage.

WILLOW SPRINGS, MO.—The Central Power & Light Company, St. Louis, has taken an option on the electric distributing system of the Light, Power & Manufacturing Company with a view of supplying hydro-electric power here for light and power. The power plant of the local company was recently destroyed by fire. The Central company plans to extend its high-tension line from West Plains to Willow Springs.

PINE RIDGE, S. D.—Bids will be received by the superintendent, Pine Ridge Agency, United States Indian Service, until July 15, for 110-volt storage-battery and lighting equipment.

GIRARD, KAN.—Bids will be received by E. R. Walker, city clerk, until July 17, for a transmission line, transformer, etc., in connection with waterworks and sewerage extensions, for which bids will be received at the same time. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

Southern States

LATTIMORE, N. C.—The City Council is considering an issue of $15,000 in bonds for the installation of an electric light plant.

GRAY COURT, S. C.—Bonds have been authorized for the establishment of an electric light plant.

SPARTANBURG, S. C.—The Southern Railway System, Washington, D. C., plans to build a steam-operated electric power plant at its proposed local car construction and repair shops, to cost about $1,350,000. Dwight P. Robinson & Company, Inc., 125 East Forty-sixth Street, New York, are engineers and contractors.

ATLANTA, GA.—The United Cleaners, Inc., P. O. Box 1652, are planning to purchase an engine-generator set, 60-cycle, three-phase, and accessory equipment.

DAYTONA, FLA.—The Daytona Public Service Company plans extensions and improvements in its power plant, including the installation of a 2,500-kw. turbo-generator, etc.

LAKE CITY, FLA.—Bonds to the amount of $40,000 have been voted for the installation of an electric lighting system.

BIRMINGHAM, ALA. — Improvements are contemplated by the Alabama Power Company at its Bessemer and Leeds substations, to cost more than $500,000. The work will include the installation of 15,000-kva. condenser at Bessemer and a 12,500-kva. condenser at Leeds. New buildings are being erected at both places. Provision is being made in the building at Bessemer for a second condenser to be installed in the future. In addition ten new oil switches will be installed at Bessemer to replace equipment now in use. The switching yard at Leeds is being enlarged to care for four additional units.

FIVE POINTS, ALA. — The Alabama Power Company plans to extend its lines to Five Points to furnish electricity here.

ALGIERS, LA.—Plans are being considered to rebuild the plant of the South New Orleans Light & Traction Company, recently destroyed by fire. The company purchases power from the New Orleans Public Service Company, and its lines extend to Amesville, Gretna, Harvey and Westwego.

VIVIAN, LA.—The installation of an ornamental lighting system in the downtown section of the city is under consideration.

CANTON, OKLA.—Bonds to the amount of $12,000 have been authorized for completing and extending the electric lighting system.

Pacific and Mountain States

ABERDEEN, WASH.—The Grays Harbor Railway & Light Company has been granted franchises by the County Commissioners to erect transmission lines in the Wishkah Valley, north of Aberdeen, and on the Junction City road and in Junction City.

ALMIRA, WASH. — The Washington Water Power Company is planning to erect a transmission line from the Long Lake section.

PRIEST RAPIDS, WASH.—The Washington Irrigation Company is planning to build a dam across the Columbia River at Priest Rapids for the development of power to be used for electrochemical and electrometallurgical processes.

TACOMA, WASH.—The City Council has adopted a resolution providing for ornamental lamps on South I Street from Sixth Avenue to South Twenty-first Street.

BAKER, ORE.—Plans have been prepared by the Eastern Oregon Light & Power Company for the erection of 5 miles of transmission lines to furnish electricity at the mines northwest of Sumpter.

PORTLAND, ORE.—The Northwestern Electric Company plans to erect a substation on East Thirtieth Street, near Hawthorne Street.

LOS ANGELES, CAL.—Plans have been filed by the Los Angeles Gas & Electric Company for the construction of a substation at 826 South Coronda Street, to cost about $20,000.

LOS ANGELES, CAL.—Plans have been filed by the Los Angeles Gas & Electric Company for the construction of an automatic power substation at 428 South Hope Street, to cost about $80,000.

LOS ANGELES, CAL.—The City Council has passed an ordinance providing for an ornamental lighting system on Washington Street and on La Brea Avenue. The first noted will require 168 cast-iron standards and the La Brea Avenue installation thirty concrete standards. An ordinance providing for ornamental lamps on California Avenue from Ocean Avenue to Seventh Street has been adopted by the Council.

MERIDIAN, CAL.—The Pacific Gas & Electric Company plans extensions and improvements in its local substation, to cost about $32,250.

SAN FRANCISCO, CAL.—The Railroad Commission has authorized the Pacific Gas & Electric Company to sell $5,000,000 in capital stock (at not below 92), the proceeds to be used to finance additions and improvements to its property and that of the Mount Shasta Power Company.

STOCKTON, CAL.—Bonds to the amount of $346,000 have been voted to install a fire-alarm system throughout the city and to purchase motor fire equipment. W. B. Hogan is city engineer.

SAFFORD, ARIZ.—The Safford Light & Power Company has applied for permission to supply electricity in Safford and also to extend its transmission lines to Thatcher, Central, Pima, Solomonville and to the districts lying to the south; also to issue $10,000 in bonds to finance the project.

MISSOULA, MONT. — The Utah-Idaho Sugar Company, Salt Lake City, Utah, contemplates the construction of a power plant at its proposed local sugar mill.

PINE BLUFF, WYO.—The Pine Bluffs Light & Power Company contemplates erecting a 13,200-volt transmission line from Pine Bluff to Burns, Wyo., this year. This line would be built and owned by the town of Burns. E. H. Narvey is superintendent.

Canada

GLACE BAY, N. S.—Bonds to the amount of $131,500 have been authorized by the ratepayers, of which $16,000 will be used for improvements to the municipal electric plant.

BALA, ONT.—The Bala Electric Light & Power Company plans to build a new power plant to cost about $40,000.

HULL, QUE.—The E. B. Eddy Company contemplates extensions to its plant, to cost about $2,000,000. A new paper mill will be erected, with an initial output of 100 tons daily. Contract has been made for an additional 6,000 hp. of electrical energy from the new power development of the Ottawa & Hull Power Company at Bryson.

MATAPEDIA, QUE.—The Matapedia Valley Light & Power Company has authorized an issue of $350,000 in bonds, the proceeds to be used for the erection of a 66,000-volt transmission line from the power plant of the Lower St. Lawrence Power Company at Grand Metis Falls to Matapedia, a distance of 84 miles.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 3, 1924)

1,496,566. IMPULSE COUPLING; H. Tiedemann, Newark, N. J. App. filed Sept. 1, 1920. Applied to generator of internal-combustion engine.

1,496,567. PHONOGRAPH; E. J. Tomlinson, Summerford, Ohio. App. filed April 7, 1919. Electrically driven.

1,496,575. VANITY LIGHT CASE; D. M. Hanna, Milledgeville, Ill. App. filed April 3, 1923.

1,496,596. IGNITING DEVICE; L. A. M. Phelan, Beloit, Wis. App. filed Dec. 23, 1922. For the electrical ignition of combustible fluid, such as oil in the form of a spray as commonly burned in fireboxes of boilers and heating plants.

1,496,598. LIGHTING SYSTEM FOR CARS; B. Rabinowitz, Brooklyn, N. Y. App. filed Nov. 3, 1921. Automatic means for throwing on the lights when the train is about to enter a tunnel.

1,496,603. CLAMP; M. R. Rothenberger, Dresden, Germany. App. filed Dec. 15, 1922. For electrical conductor.

1,496,605, 1,496,606. PROCESS FOR PRODUCING FERRIC PIGMENTS; H. F. Saunders, Cleveland, Ohio. App. filed Feb. 9, 1922.

1,496,607. PROCESS FOR PRODUCING FERRIC OXIDE; H. F. Saunders, Cleveland, Ohio. App. filed Aug. 3, 1922.

1,496,632. TERMINAL SERVICE BOX; W. B. Herbst, Pittsburgh, Pa. App. filed Sept. 23, 1921. For sealing the cable.

1,496,646. TROLLEY-POLE MOUNTING; J. E. Kean, Birmingham, Ala. App. filed Aug. 27, 1923.

1,496,655. GONG-RINGING APPARATUS; J. H. Cullom, Rosemary, N. C. App. filed July 15, 1922.

1,496,669. ELECTRIC WATER HEATER; L. G. Fish, Woonsocket, R. I. App. filed June 21, 1923. For use in connection with one or more radiators for heating purposes.

1,496,671. DETECTOR; H. Gernsback, New York, N. Y. App. filed Feb. 24, 1923. Of the crystal type.

1,496,674. CLOSED ELECTRIC FURNACE; A. Helfenstein, Vienna, Austria. App. filed Feb. 7, 1922. Including shafts for continuous charging, in which provision is made for advantageously recovering pure furnace gases.

1,496,725. DRY STORAGE BATTERY; W. W. Moore, San Antonio, Tex. App. filed Jan. 19, 1923. In which the electrolyte is a solid mass.

1,496,745. POTENTIOMETER; H. S. Scott, Cleveland, Ohio. App. filed June 13, 1923.

1,496,755. STATIC-POTENTIAL-CONTROLLING APPARATUS; R. M. Gilson, Pittsburgh, Pa. App. filed June 14, 1919. For controlling the potential applied to energy-consuming devices which are known to be limited as to life.

1,496,759. TERMINAL CLAMP; O. C. Rhode, Toledo, Ohio. App. filed Oct. 4, 1920. For electrical conductors for use in connection with the lead wires of spark plugs.

(Issued June 10, 1924)

1,496,768. VIBRATION REDUCING MOUNTING DEVICE FOR SIGNALING SYSTEMS; W. T. Booth, East Orange, N. J. App. filed March 27, 1918. As where vacuum tubes are employed.

1,496,769. TELEPHONE SYSTEM; L. J. Bowne, Howard Beach, N. Y. App filed May 29, 1922. Telephone circuits used in connection with transmission lines composited for simultaneous telephony and telegraphy.

1,496,772. PAY-STATION AUTOMATIC TELEPHONE SYSTEM; R. S. Conway, Chatham, N. J. App. filed March 17, 1921.

1,496,775. CURRENT-CONTROL SYSTEM; C. T. Evans, Milwaukee, Wis. App. filed Nov. 15, 1917. For a type known as lock-out switch systems.

1,496,786. PORTABLE IMPEDANCE BRIDGE; W. J. Shackelton, Scotch Plains, N. J. App. filed Jan. 29, 1921. For testing.

1,496,817. ELECTRICAL CONNECTOR; G. E. Mather, East Orange, N. J. App. filed Dec. 28, 1918. For making a quickly detachable connection between a conducting cord and an apparatus box.

1,496,818. ELECTRICAL SWITCHING CIRCUIT; D. T. May, New York, N. Y. App. filed Dec. 21, 1920. In which means is provided to eliminate excessive sparking at the switch contacts.

1,496,829. STORAGE BATTERY; C. C. Rich, Mount Vernon, N. Y. App. filed Aug. 9, 1922. Lead type.

1,496,831. OVERLOAD SWITCH FOR ALTERNATING CURRENT; L. Schon and J. Pfretzschner, Essen, Germany. App. filed Sept. 4, 1920. Having a magnetic field adapted to be excited both by the current of the circuit which is to be protected and by an auxiliary circuit.

1,496,845. PROCESS OF PRODUCING PURE CHROMIUM BY ELECTROLYSIS; G. Grube, Stuttgart, Germany. App. filed April 13, 1923.

1,496,847. TELEPHONE-EXCHANGE SYSTEM; H. L. Hoffmann St. Louis, Mo. App. filed Sept. 6, 1919. Where manual and automatic exchanges are on the same system.

1,496,848. SELECTIVE SIGNALING SYSTEM; W. H. T. Holden, New York, N. Y. App. filed Jan. 9, 1923. For selective party-line telephone systems.

1,496,869. ELECTRIC LIGHTING SYSTEM AND MEANS THEREFOR; W. Brooke, Hale, England. App. filed April 17, 1923.

1,496,875. IMPULSE-TRANSMITTING MECHANISM; J. C. Field, Orange, N. J. App. filed Jan. 13, 1922. Rotary distributor type.

1,496,892. LIGHTING FIXTURE; B. F. Klein and E. O. Fox, Cleveland, Ohio. App. filed March 13, 1922.

1,496,919. AUDIPHONE; M. L. Bellus, Chicago, Ill. App. filed Nov. 2, 1921.

1,496,930. WELDING ELECTRODE AND METHOD OF MAKING SAME; W. H. Flood, Tooting, and D. T. Smout, West Dulwich, London, England. App. filed Feb. 7, 1922.

1,496,936. WELD AND PROCESS OF FORMING THE SAME; T. W. Lowe, Winnipeg, Manitoba, Canada. App. filed Dec. 8, 1921.

1,496,966. ELECTRODE AND METHOD OF MAKING SAME; W. G. Allan, Toronto, Ontario, Canada. App. filed Sept. 2, 1920. Unipolar electrodes for electrolyzers.

1,497,002. INCLOSURE FOR SPLICED ENDS OF ELECTRIC CABLES; C. H. Sanderson, Nutley, N. J. App. filed May 21, 1921. Solderless.

1,497,047. MEANS FOR SUSPENDING WIRES, CABLES AND THE LIKE; S. M. Viele, Altoona, and H. K. Le Sure, Philadelphia, Pa. App. filed March 12, 1923. Catenary type.

1,497,060, 1,497,061. ELECTRIC SWITCH; T. A. Both, Stratford, Conn. App. filed April 21, 1919. Quick-make and quick-break.

1,497,071. AUTOMATIC ARC-WELDING MACHINE; S. S. Daykin, Cleveland, Ohio. App. filed May 2, 1921.

1,497,080. IGNITION TIMING MECHANISM; C. A. Robertson, Springfield, Ohio. App. filed Nov. 14, 1921. For internal-combustion engines.

1,497,082. TELEPHONE-EXCHANGE SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y. App. filed Dec. 24, 1920. Automatic.

1,497,095. ELECTRICAL CONDENSER; W. Dubilier, New York, N. Y. App. filed May 23, 1922. For use in radio and other electrical apparatus.

1,497,160. METHOD OF PREVENTING LOSS OF ZINC IN AN ELECTRIC BATTERY. A. Pouchain, Turin, Italy. App. filed Aug. 18, 1920. By coating the zinc electrode with mineral grease.

1,497,161. ELECTRIC ACCUMULATOR; A. Pouchain, Turin, Italy. Method of plate arrangement and support.

1,497,173. PROCESS OF AND APPARATUS FOR OXIDIZING GASES; I. Heckenbleikner, Charlotte, N. C. App. filed June 22, 1921. Using an electric furnace.

1,497,178. ELECTRIC LEVEL INDICATOR FOR LIQUIDS; C. O. Lorenz, Port Arthur, Tex. App. filed July 20, 1917. For gaging any liquids lying in strata which differ in electrical conductivity as oil and water.

1,497,194. RADIO ALARM SYSTEM; J. Norden, New York, and A. F. Waltz, Brooklyn, N. Y. App. field April 13, 1922.

1,497,223. DRYING ROLLS FOR PAPER MILLS; R. P. Moodie, Ottawa, Ontario, Canada. App. filed June 23, 1921. Electrically heated.

1,497,225. PORTABLE ENGINE-TESTING INSTRUMENT; M. E. Pittman, Amarillo, Tex. App. filed Oct. 14, 1922. For testing multiple-cylinder, internal-combustion engines having electric ignition.

1,497,265. ZINC-ELECTROPLATED ARTICLES; J. Haas, Jr., Muncie, Ind. App. filed Sept. 16, 1922.

1,497,281. ELECTRIC CONTROL SYSTEM; G. B. Morris, Pasadena, Cal. App. filed Nov. 23, 1921. For remote control as in manipulating theater curtains.

1,497,284. TELEPHONE-EXCHANGE SYSTEM; L. Polinkowsky, Antwerp, Belgium. App. filed Dec. 31, 1919. Automatic.

1,497,285. TELEPHONE-EXCHANGE SYSTEM; A. Raynsford, New York, N. Y. App. filed May 4, 1921. Automatic and manual offices interconnected by trunks.

1,497,287. TELEGRAPH SYSTEM; J. H. Bell, South Orange, N. J. App. filed Dec. 19, 1921. To prevent false operation of the telegraph sounder when signals are being transmitted over a composite telephone and telegraph system.

1,497,299. SYSTEM OF WAVE TRANSMISSION; J. Mills, Wyoming, N. J. App. filed June 29, 1917. For selectively transmitting current of a given frequency to the exclusion of current of different frequency.

1,497,300. SIGNALING APPARATUS; P. H. Minton, Chatham, N. J. App. filed June 23, 1922. Automatic annunciator for heating units, as furnaces.

1,497,309. ELECTRIC REGULATOR; H. M. Stoller, Mountain Lakes, N. J. App. filed Feb. 15, 1922. For regulating the voltage or current output of a generator as employed in a train-lighting system.

1,497,312. INDUCTION MOTOR; P. L. Alger, Schenectady, N. Y. App. filed Jan. 21, 1921. With windings arranged to prevent operation at a subsynchronous speed.

1,497,316, 1,497,317. BATTERY; J. M. Askin, Chicago, Ill. App. filed Feb. 1, 1919. Of the dry type arranged to be assembled by the dealer.

1,497,319. INSULATOR; A. O. Austin, Barberton, Ohio. App. filed Dec. 3, 1919. Suspension type.

1,497,328. JERKWISE-ACTING DRIVING DEVICE FOR IGNITION APPARATUS; O. Fischer, Stuttgart, Germany. App. filed Oct. 27, 1921. For effecting ignition at low speed.

1,497,353. AUTOMATIC ELECTRIC COUPLING; H. F. Woernley, Pittsburgh, Pa. App. filed July 5, 1918.

1,497,366. METHOD AND APPARATUS FOR SIGNALING; R. A. Fessenden, Chestnut Hill, Mass. App. filed Aug. 3, 1920. To determine the phase relation between different components of the same signal.

1,497,382. MAGNETIC TOY; C. A. Rollason, Southport, England. App. filed Jan. 15, 1923.

1,497,384. RADIANT-ENERGY RECEIVER; H. G. Saal, Chicago, Ill. App. filed May 11, 1922. Mounting for wire of crystal detector.

1,497,388. METHOD OF AND APPARATUS FOR INDICATING THE ELECTRICAL CONDITION OF A CELL; E. M. Sterling, New York, N. Y. App. filed Nov. 3, 1922.

1,497,393. MAGNETO-ELECTRIC IGNITION APPARATUS; W. Walther, Stuttgart, Germany. App. filed Aug. 11, 1921. In which more than two sparks can be produced in a single rotation of the rotating member.